

# MME at NCEP

Aug, 16, 2011  
CPC\_all hands\_mtg

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Acknowledgements follow

# Opinions

- MME is no substitute for model improvement
- As the CFS improves (and all other models as well) we phase out MME in the sense that model diversity becomes less important and ultimately only the initial perturbations matter, which can be done by a single model. MME is a temporary activity (how temporary?)
- We can all be very comfortable in models being very bad NOW, and staying bad for the next 100 years, thus necessitating MME as a perpetual albeit temporary approach
- Low predictability should not be confused with a model being bad.

# MME

- MME history
- NMME (why now?, skill, examples Aug 2011)
- IMME (one slide)
- Why hindcasts?, how many years
- Threats to MME in real time

# History

- MME has subjectively always appealed to the human forecaster
- ‘Consensus’ (Sanders, MIT)
- CPC practice for 6-10, NAEFS
- A more formal approach has been elusive because 1) hindcasts are required (how many hindcasts?), 2) methods of consolidation, 3) it has to be worth the trouble, 4) almost unsurmountable co-linearity

# NMME for seasonal prediction

- The idea (or external push on NCEP) has been around for years, ever since Demeter, CTB ..
- Has been difficult among other things because the working idea was that NCEP would have to run hindcasts and/or realtime forecasts of other institution's model.
- NOW these institutions will do this themselves and simple supply us with the hindcasts and real-time forecasts, playing by our rules.

# Hindcast Situation NMME

	startmonths available NOW	Period	Members
CFSv1	12	1981-2009	15
CFSv2	12	1982-2009	24(28)
GFDL-CM2.2	>2	1982-2010	10
IRI-Echam4-f	>2	1982-2010	12
IRI-Echam4-a	>2	1982-2010	12
CCSM3.0	>2	1982-2010	6

# Hindcast Situation

	Arrangement of Members	Leads
CFSv1	1st 0Z +/-2days, 21st0Z+/-2d, 11th0Z+/-2d	0-9 months
CFSv2	4 members (0,6,12,18Z) every 5th day	0-9
GFDL-CM2.2	All 1st of the month 0Z	0-11
IRI-Echam4-f	All 1st of the month**	0-7
IRI-Echam4-a	All 1st of the month**	0-7
CCSM3.0	All 1st of the month**	0-11

Model resident  
Resolutions

	Atmosphere	Ocean	Reference
CFSv1	T62L64	MOM3L40 0.30 deg Eq	Saha et al(2006)
CFSv2	T126L64	MOM4 L40 0.25 deg Eq	Saha et al 2010 Delworth et al
GFDL-CM2.2	2X2.5deg L24	MOM4 L50 0.30 deg Eq MOM3 L25 0.5 deg Eq	2006 DeWitt MWR (2005)
IRI-Echam4-f	T42L19	MOM3 L25 0.5 deg Eq	"
IRI-Echam4-a	T42L19	POP L40 0.3 deg Eq	Kirtman and Min (2009)
CCSM3.0	T85L26		

\*\* The CCSM and IRI has an arbitrarily selected (from an AMIP run) state for atmosphere and soil - the initialization date only applies to the ocean which may use some data in the future (where possible).

Notes: 1) All forecast data sets are given to NCEP at 1X1 (360X181) degree and gribbed at NCEP

Notes: 2) Only monthly mean data of tmp2m, prate and sst is requested at this point

Notes: 3) Obs data set 1 (monthly mean) at 1X1 based on GHCN\_CAMS (monthly tmp2m, Fan+Van den Dool 2008 0.5X0.5 degree 1948-last month)

Notes: 4) Obs data set 2 (monthly mean) at 1X1 based on CPC\_Unified (land-only daily raingauge, Xie 2010 0.5X0.5 degree 1979-recent)

Notes: 5) Obs data set 3 (monthly mean) at 1X1 based on CMAP (global 5 day mean precip, Xie and Arkin 1997, 2.5X2.5 degree 1979-recent)

Notes: 6) Obs data set 4 (monthly mean) at 1X1 based on SST OI (daily SST, Reynolds et al (2007). 0.25X0.25 degree, sept 1981-recent)

## Real Time:

Real time integrations are collected from the respective ftp sites at 5pm COB 8<sup>th</sup> of the month.

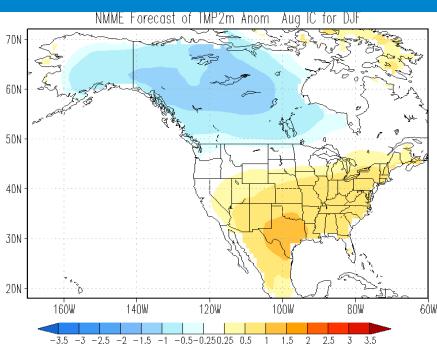
Desire: Robust scripts that can handle any number of models and members

# Real Time Forecast Situation Aug 2011 forward

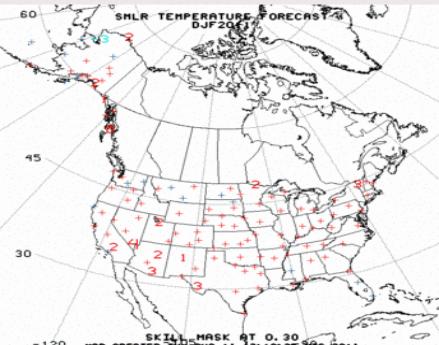
	Mem bers	Arrangement of Members	Lead s
CFSv1	28	X most recent days (4 per day)	0-9 months
CFSv2	40	Y most recent days (4 per day)	0-9
GFDL	10	All 1st of the month 0Z	0-11
IRI-f	12	All 1st of the month**	0-7
IRI-a	12	All 1st of the month**	0-7
CCSM3.0	6	All 1st of the month**	0-11

# DJF Season [Temperature]

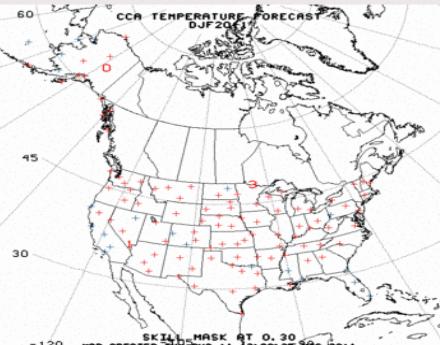
**NMME**



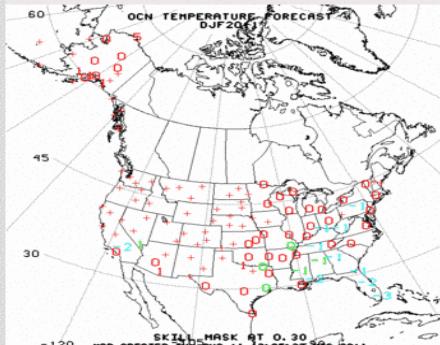
**SMLR**



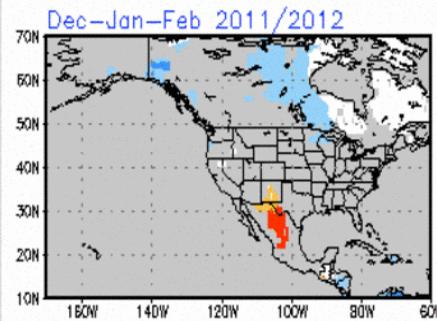
**CCA**



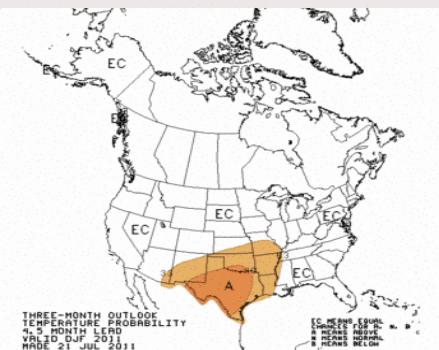
**OCN**



**CFS(V2) STD/MSKD**



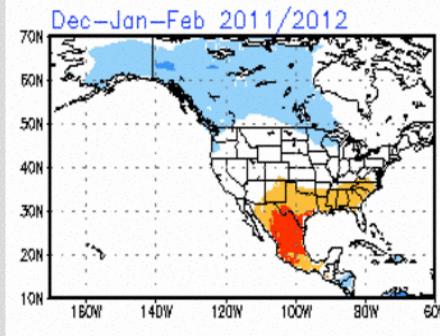
**OLD OUTLOOK**



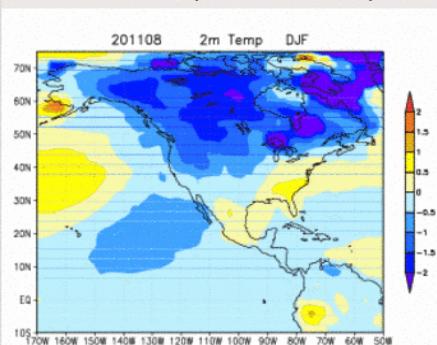
**\*\* NEW OUTLOOK \*\***

IMAGE  
NOT  
AVAILABLE

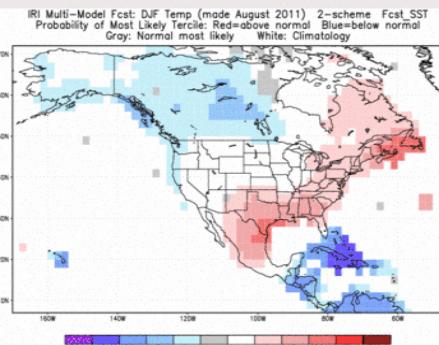
**CFS(V2) STD/UNMSKD**



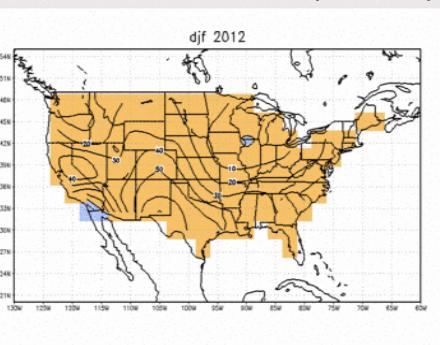
**ECPC (SCRIPPS)**



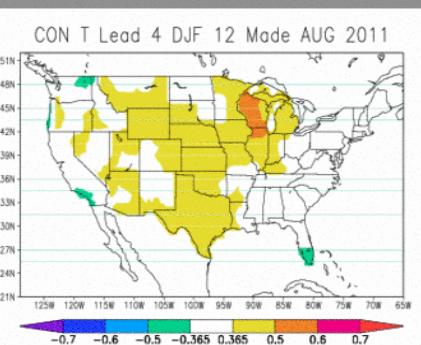
**IRI**



**ENSEMBLE CCA (ECCA)**



**CONSOLIDATION**



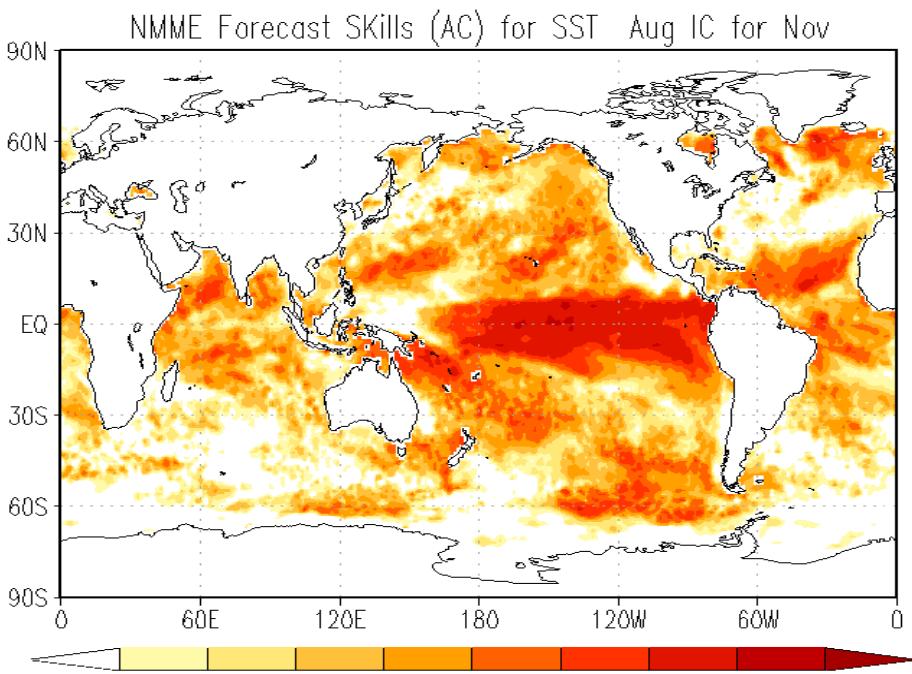
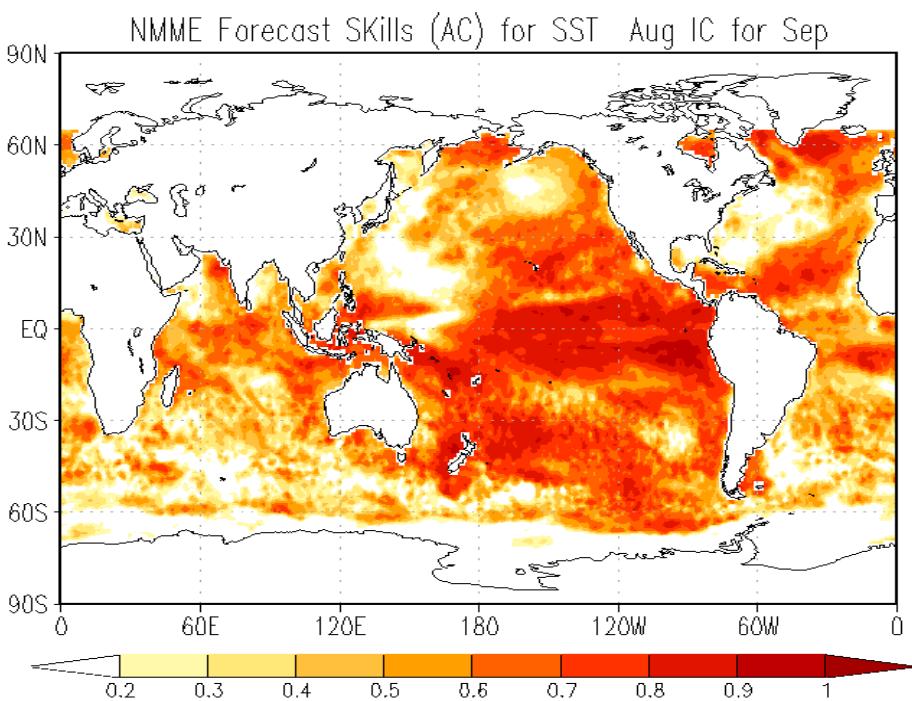
# Evaluation of NMME Forecast Skills

- Initial Conditions: August
- Equal weight for ens mean of six models:
- Only AC

# Sea Surface Temperature

Verification observation

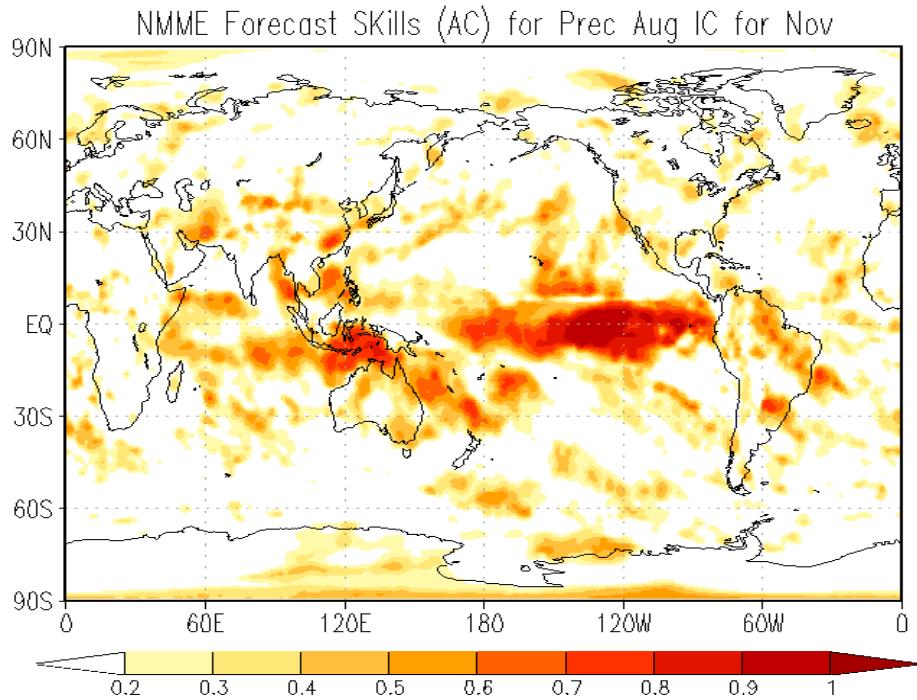
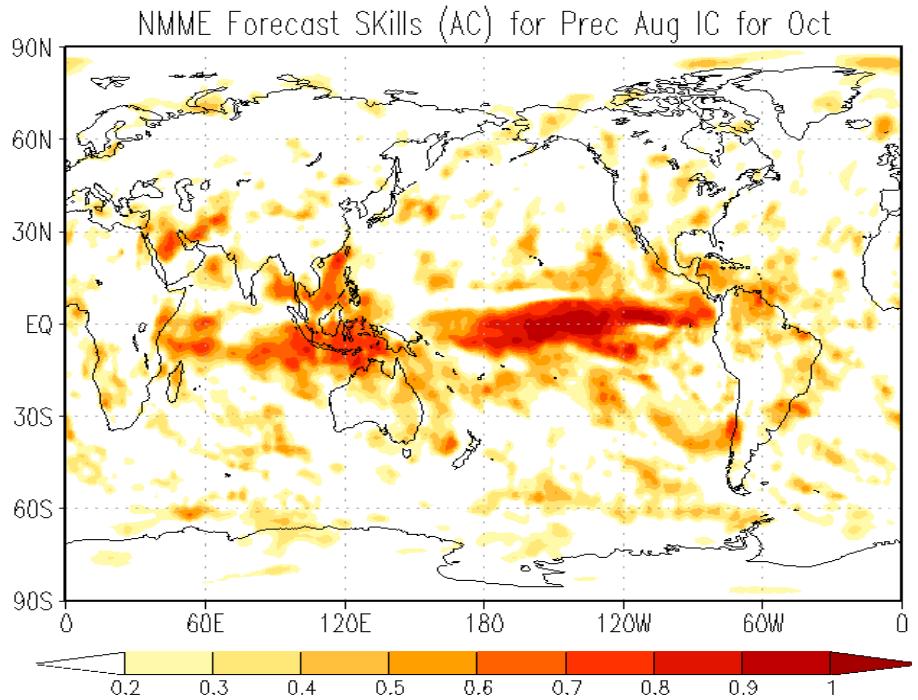
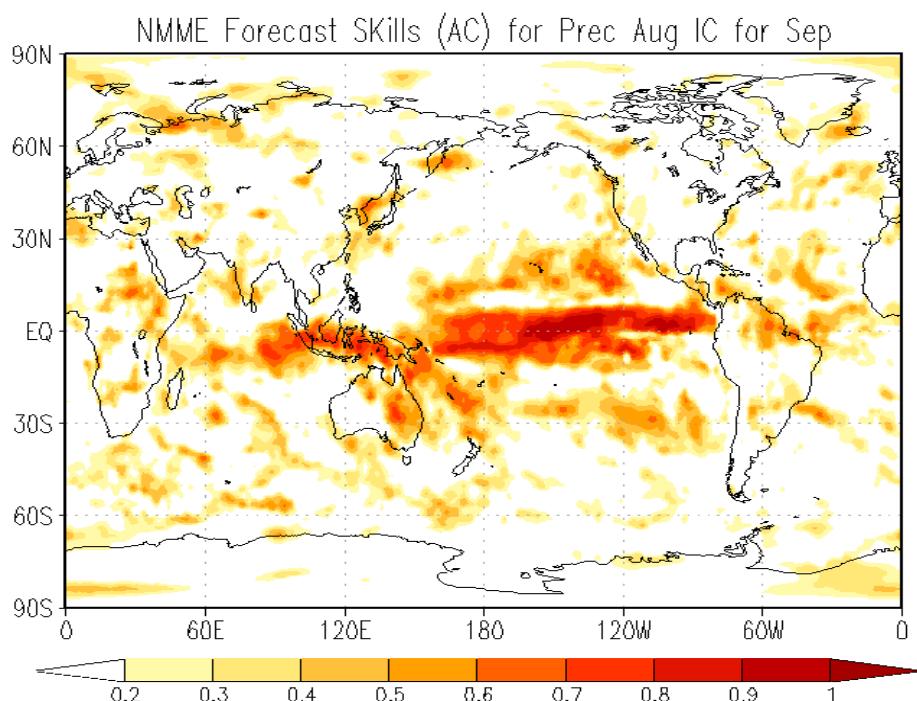
- SST OISST-QD
- 1982-2009



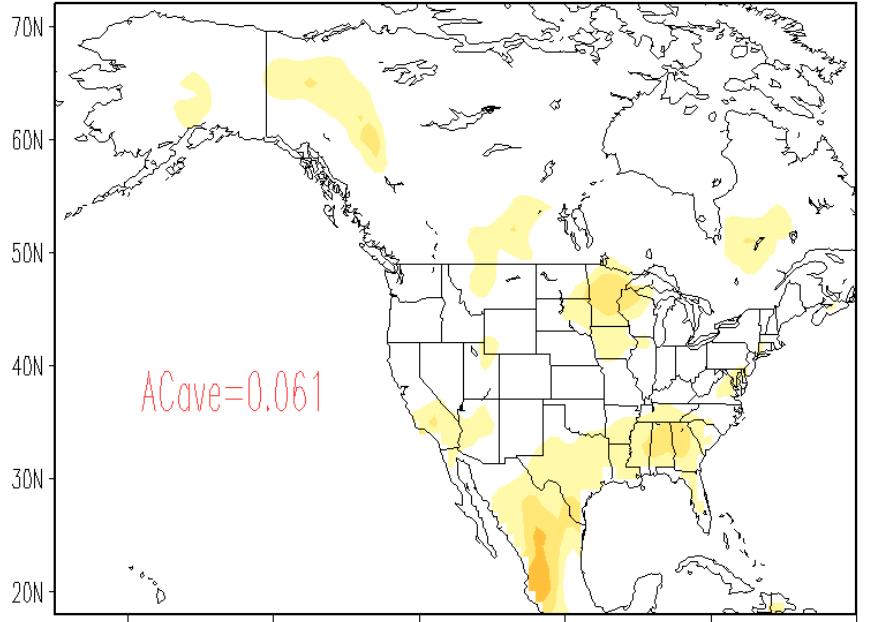
# Precipitation global

Verification observation:

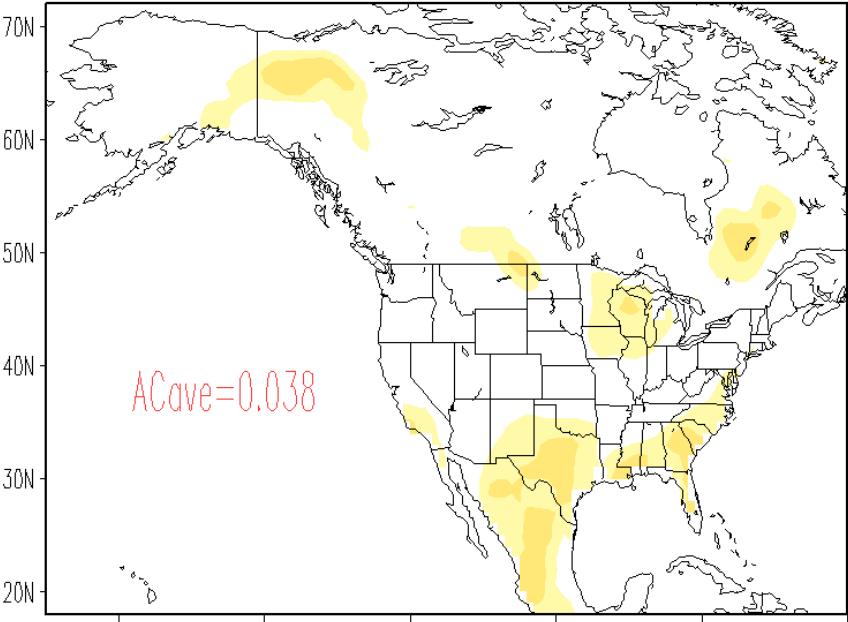
- CMAP
- 1982-2009



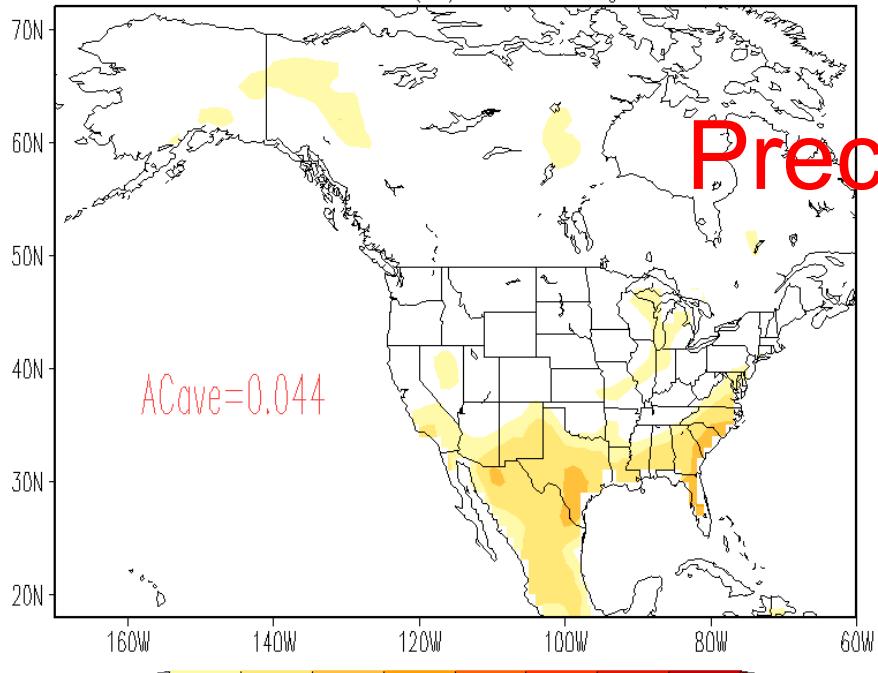
NMME Forecast SKills (AC) for Prec Aug IC for OND



NMME Forecast SKills (AC) for Prec Aug IC for NDJ

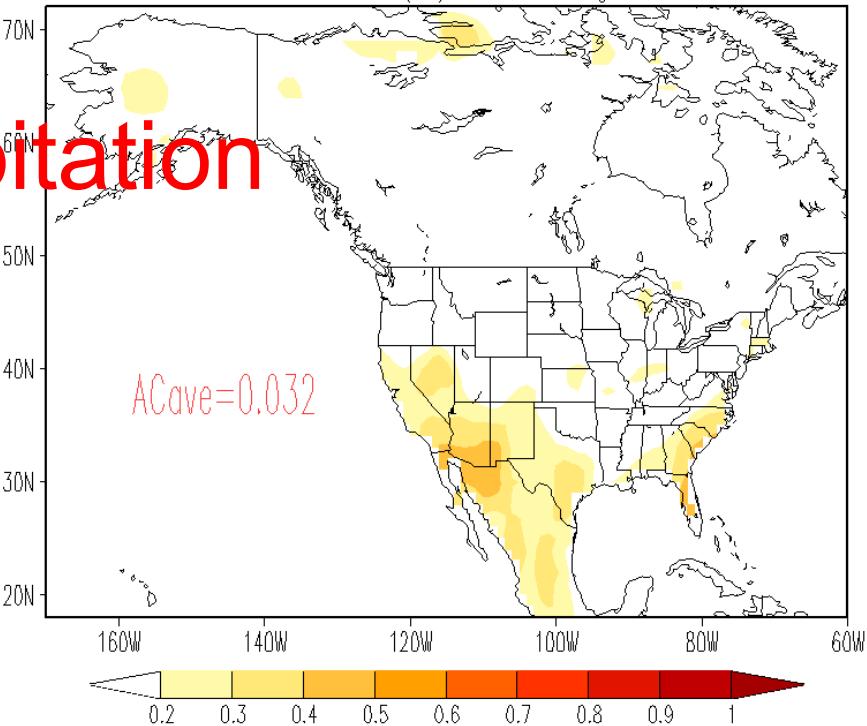


NMME Forecast SKills (AC) for Prec Aug IC for DJF



# Precipitation

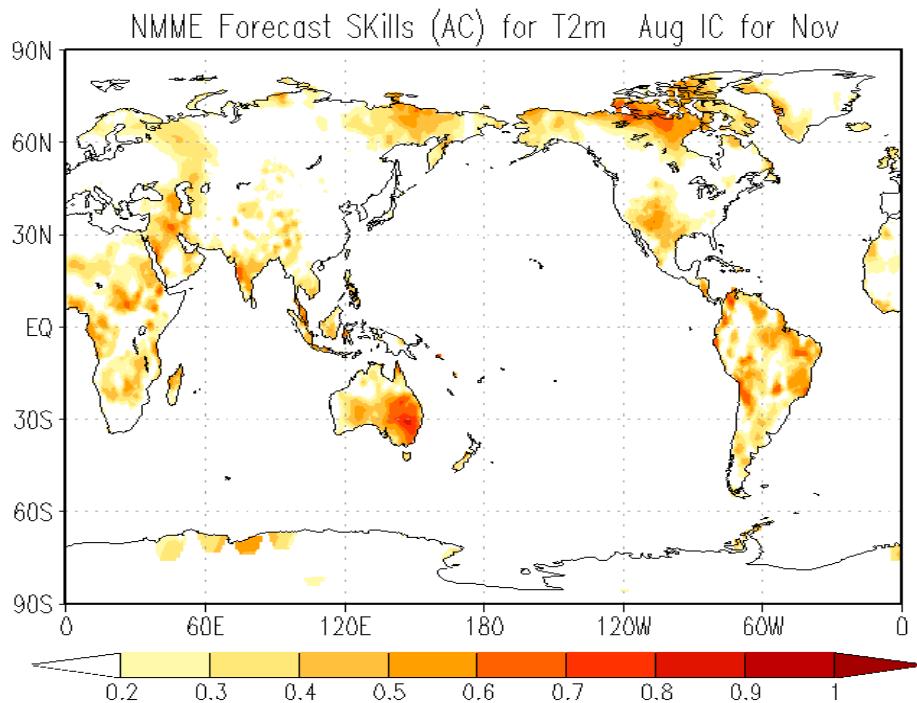
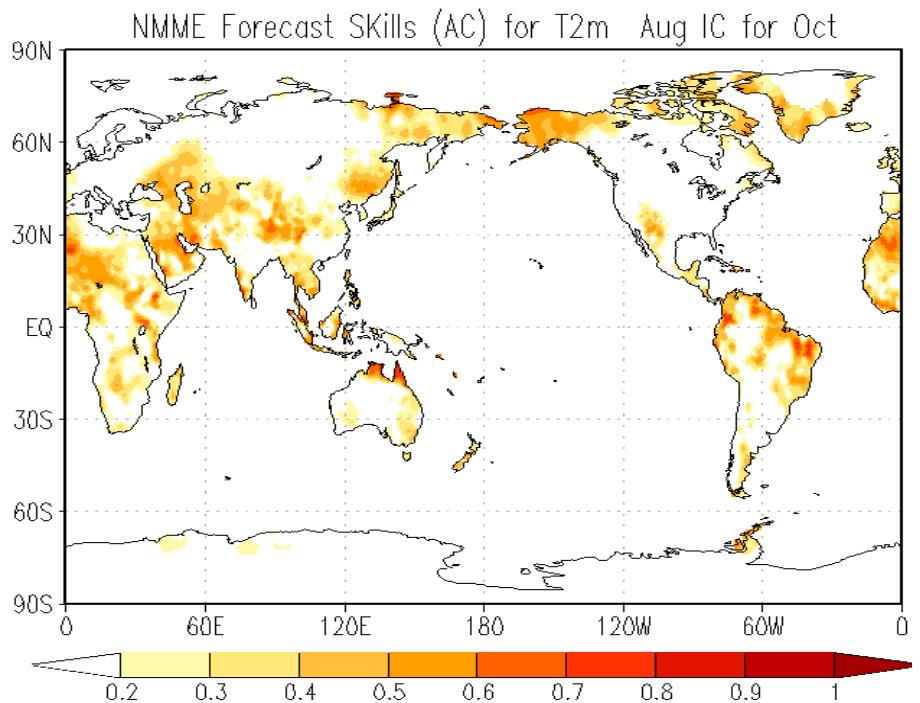
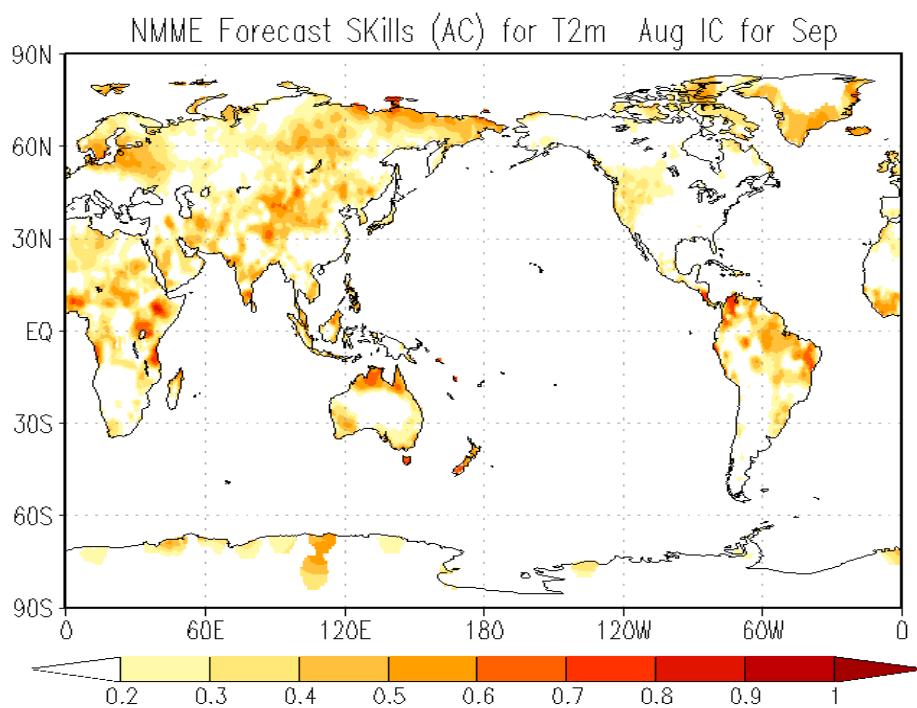
NMME Forecast SKills (AC) for Prec Aug IC for JFM



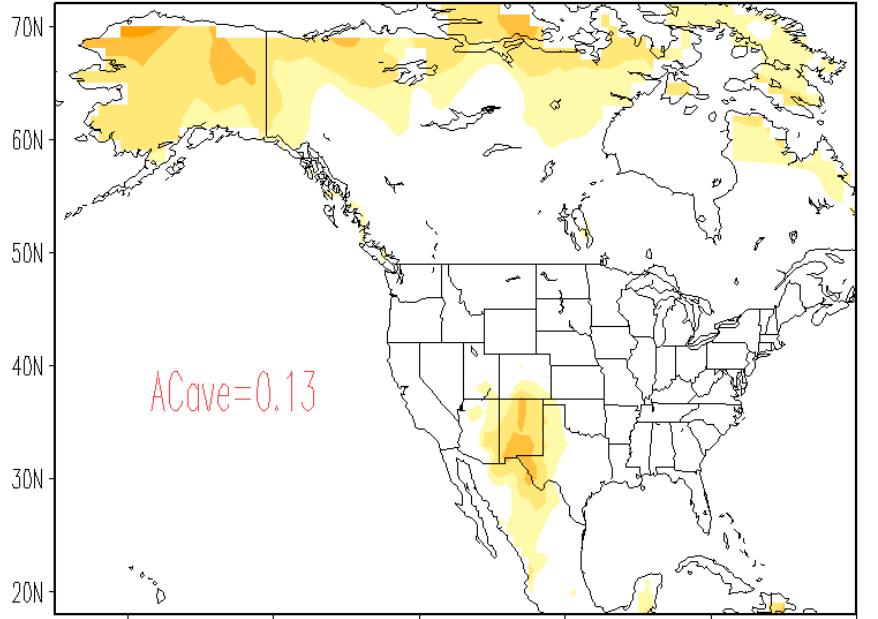
# Temperature at 2 Meter Global

## Verification observation

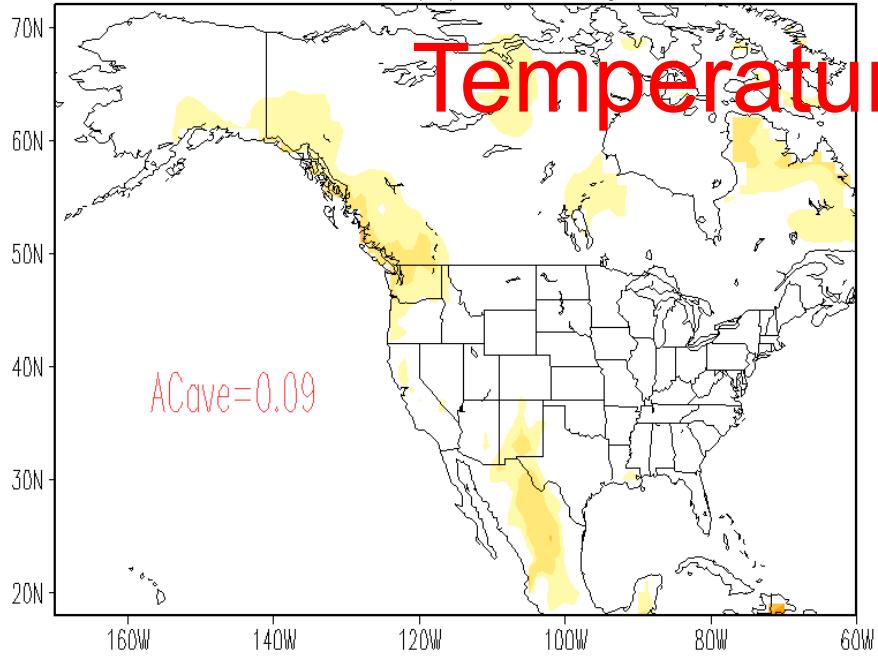
- **GHCN\_CAMS**
- **1982-2009**



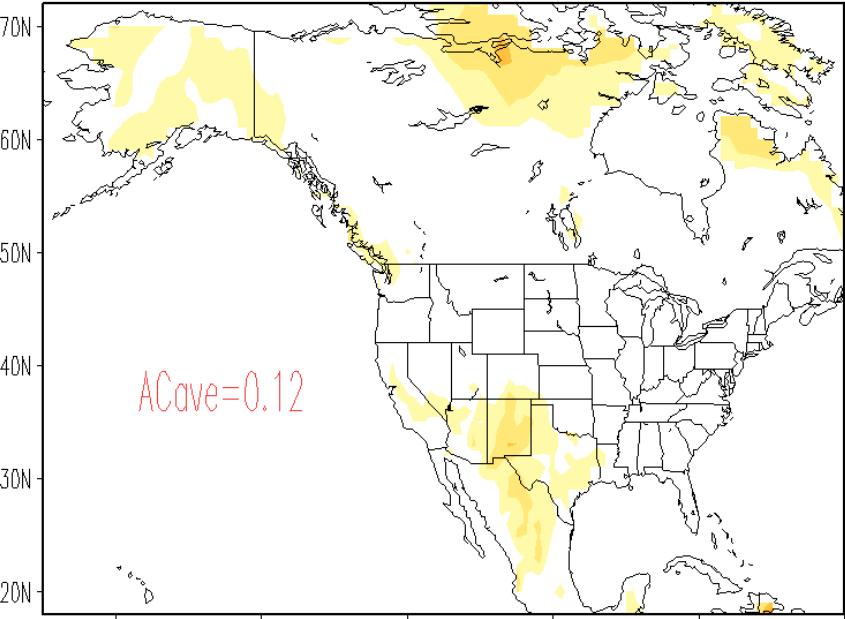
NMME Forecast SKills (AC) for T2m Aug IC for OND



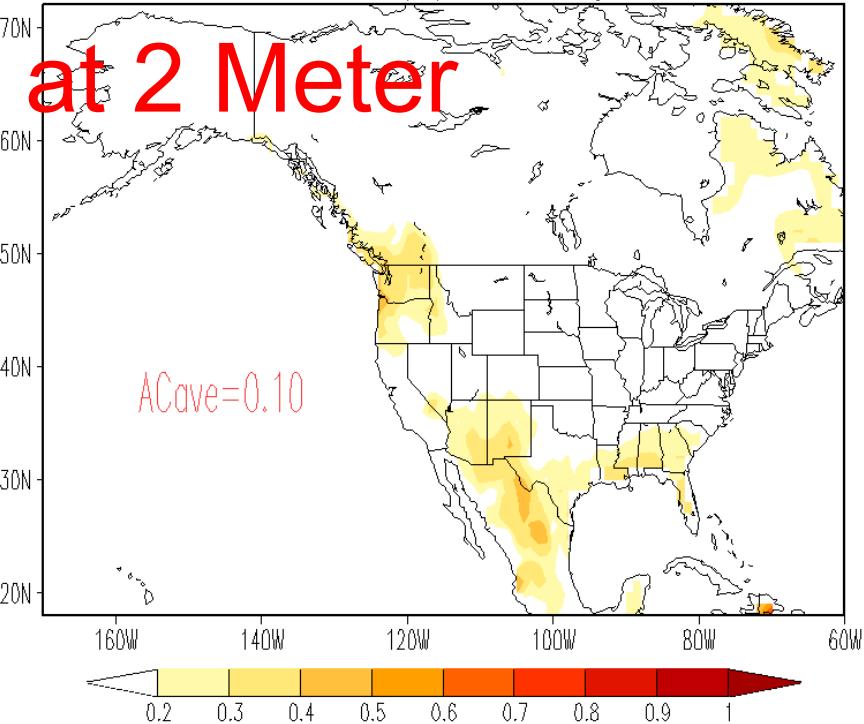
NMME Forecast SKills (AC) for T2m Aug IC for DJF



NMME Forecast SKills (AC) for T2m Aug IC for NDJ

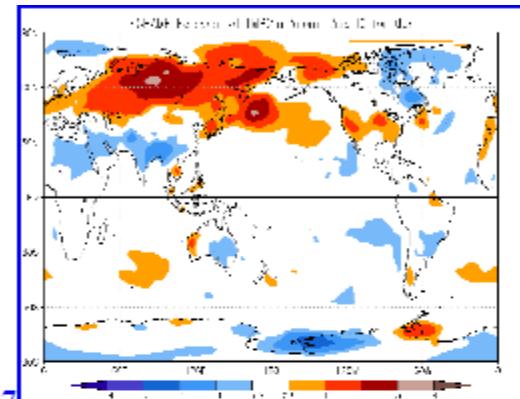
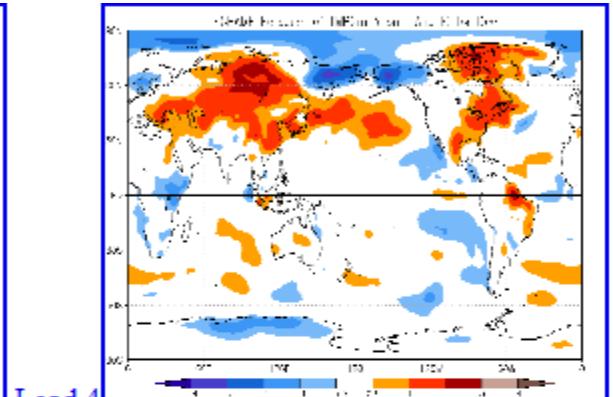
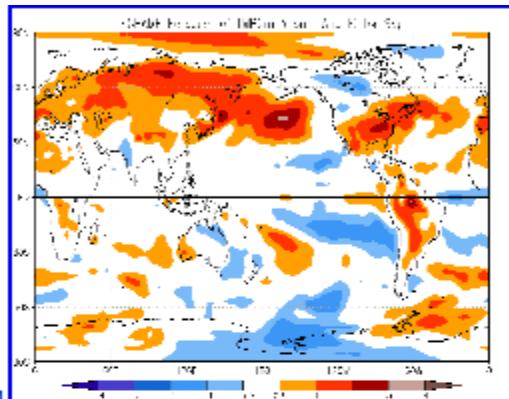


NMME Forecast SKills (AC) for T2m Aug IC for JFM



# Website for display (pardon the progress)

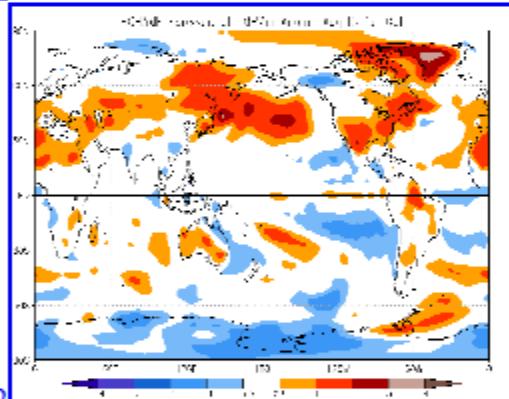
- [http://origin.cpc.ncep.noaa.gov/products/  
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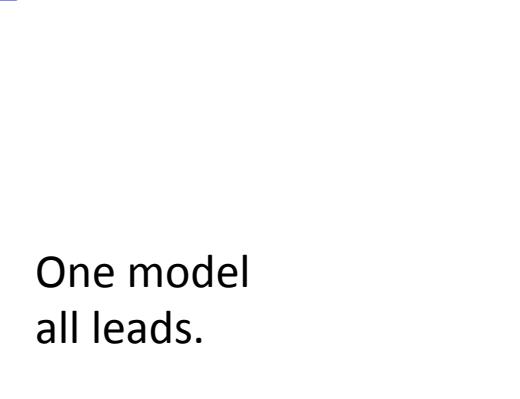
Lead 1

Lead 4

Lead 7

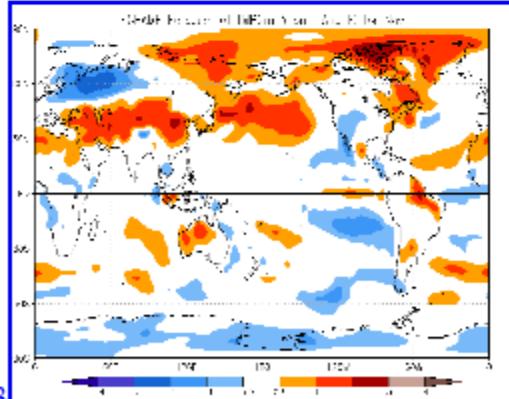


Lead 5



Lead 2

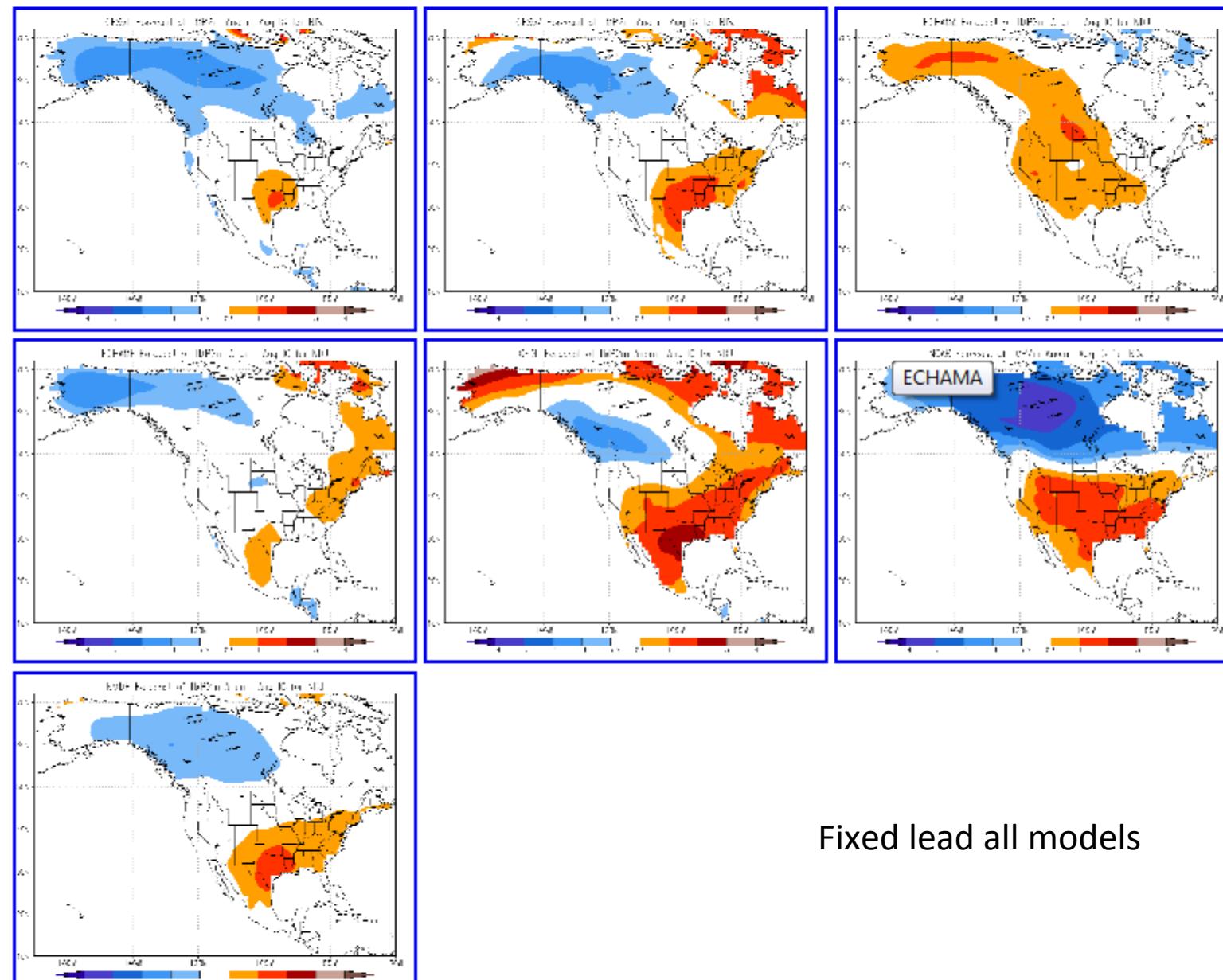
Lead 6



Lead 3

One model  
all leads.

## Season 3 tmp2m forecast



Fixed lead all models

# EUROSIP MODELS

	NCEP/CFSv1	NCEP/CFSv2	ECMWF	UKMET	METF
Atmospheric Model	T62L64	T126L64	Syst 3: T159L62	Glosea4 (120km) L85	T42L91 (T63-linear grid)
Ocean Model	MOM3 L40 0.3 deg Eq, 1deg 65N-75S	MOM4 L40 0.25 deg Eq, 0.5 deg global	HOPE L29 0.3 deg Eq 1 deg global	NEMO L75 0.3 deg Eq 1 deg global	ORCA 0.5 deg Eq 2 deg global
Atmosphere/Ocean Coupling Frequency	24 hours	30 minutes	NA*	NA*	NA*
Land Model	OSU 2-layer	NOAH 4-layer	NA*	NA*	NA*
Sea Ice Model	Climatological Seoice	3-layer interactive Seoice model	NA*	NA*	NA*
Period of Hindcasts	1981-2009 (29 years)	1982-2010 (29 years)	1981-2009 (29 years)	1989-2002 (14 years)	1981-2009 (29 years)
Number of hindcast members	15	24(28)	11	12	11
Number of Leads	0-9 months	0-9 months	0-7 months	0-6 months	0-6 months

NA\* : Not Available, but information requested

# Purpose of hindcasts:

	activity	Data requirements	Comment
1	Correct the mean	15-20 (30) years	WMO says 30
2			
3			
4			
5			

# Purpose of hindcast:

	activity	Data requirements	Comment
1	Correct the mean	15-20 (30) years	WMO says 30
2	Correction pdf	45	WMO says 45
3			
4			
5			

# Purpose of hindcast:

	activity	Data requirements	Comment
1	Correct the mean	15-20 (30) years	WMO says 30
2	Correction pdf	45	WMO says 45
3	Estimate of AC-skill to 0.15 accuracy	45	CPC rejects local forecasts $\leq 0.30$
4			
5			

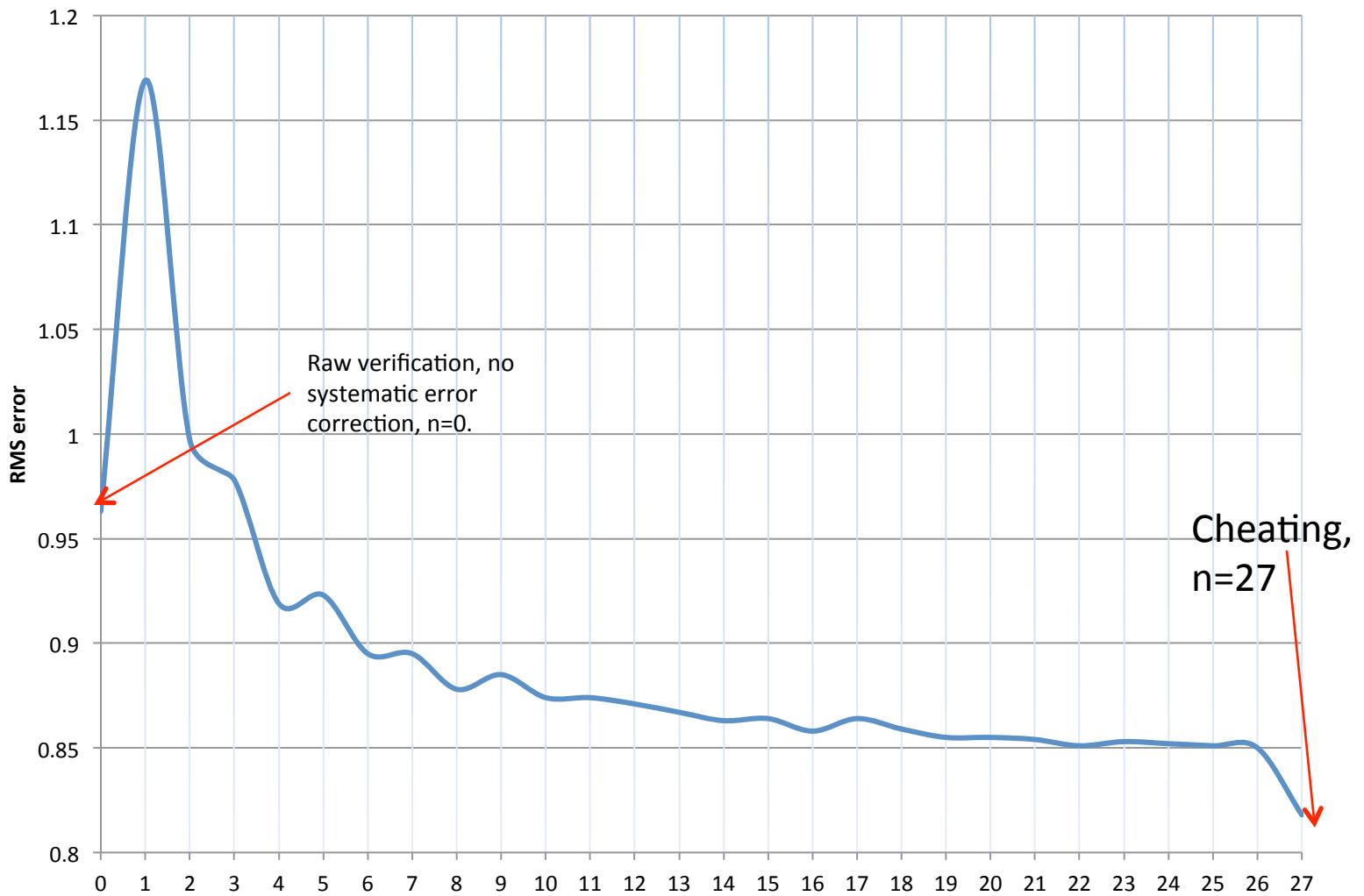
# Purpose of hindcast:

	activity	Data requirements	Comment
1	Correct the mean	15-20 (30) years	WMO says 30
2	Correction pdf	45	WMO says 45
3	Estimate of AC-skill to 0.15 accuracy	45	CPC rejects local forecasts $\leq 0.30$
4	To test whether we can tell AC-skill Mdl A > Mdl B by 0.1	More	
5			

# Purpose of hindcast:

	activity	Data requirements	Comment
1	Correct the mean	15-20 (30) years	WMO says 30
2	Correction pdf	45	WMO says 45
3	Estimate of AC-skill to 0.15 accuracy	45	CPC rejects local forecasts $\leq 0.30$
4	To test whether we can tell AC-skill Mdl A > Mdl B by 0.1	More	
5	Attempt to assign non-equal weights to models	100's to 1000's of years	Unless we become smarter

RMS error (deg C) as a function of the length hindcast data (n), for SST prediction Nino34, start Jan, lead 8



15-20 independent cases will do to correct the mean.

# Threats to (any)MME in real time:

- Many

# MME:? Better than the sum of the parts?

OR:

**“A chain is only as strong as its weakest link”**



Real-time QC is important

# Acknowledgement NMME

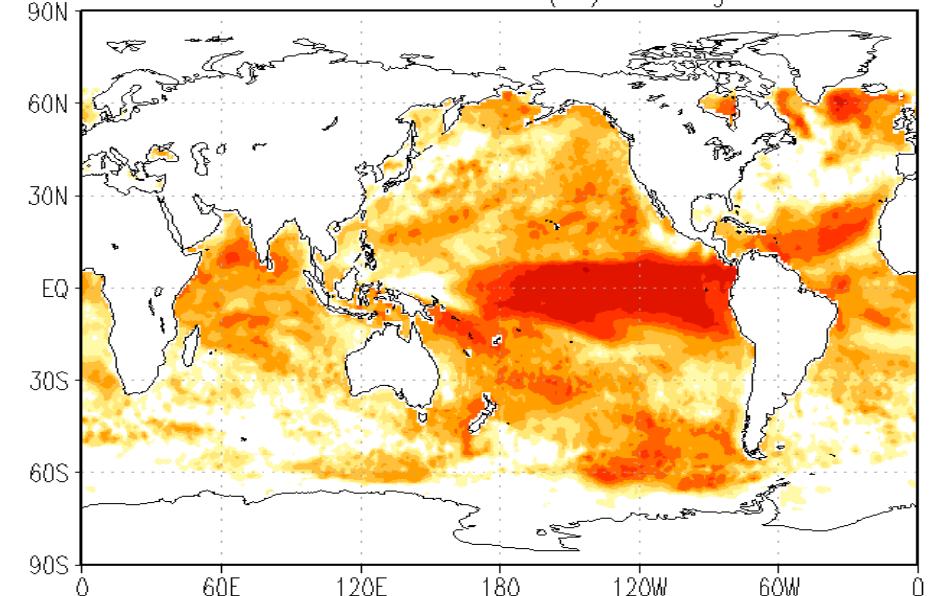
- Probably will miss some people (sorry)
- GFDL: Tony Rosati, Rich Gudgel
- IRI: Dave DeWitt
- Univ of Miami: Ben Kirtman, Duke Min, NCAR
- NASA: will be added in September
- CPO/CTB: Don Anderson/Jin Huang

# Acknowledgement IMME

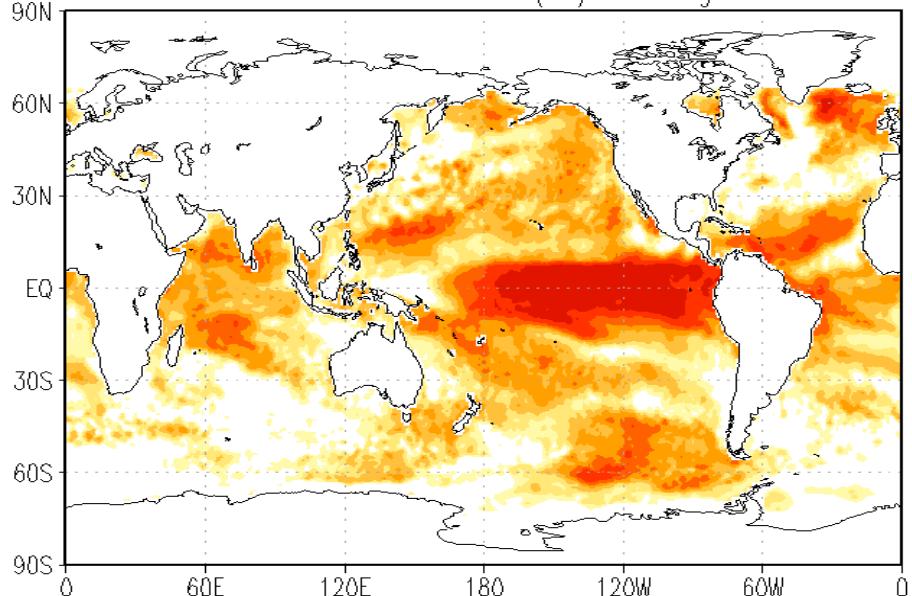
- Tim Stockdale ECMWF (many others thru him)
- No funding

# Extras

NMME Seasonal Forecast SKills (AC) SST Aug IC for OND

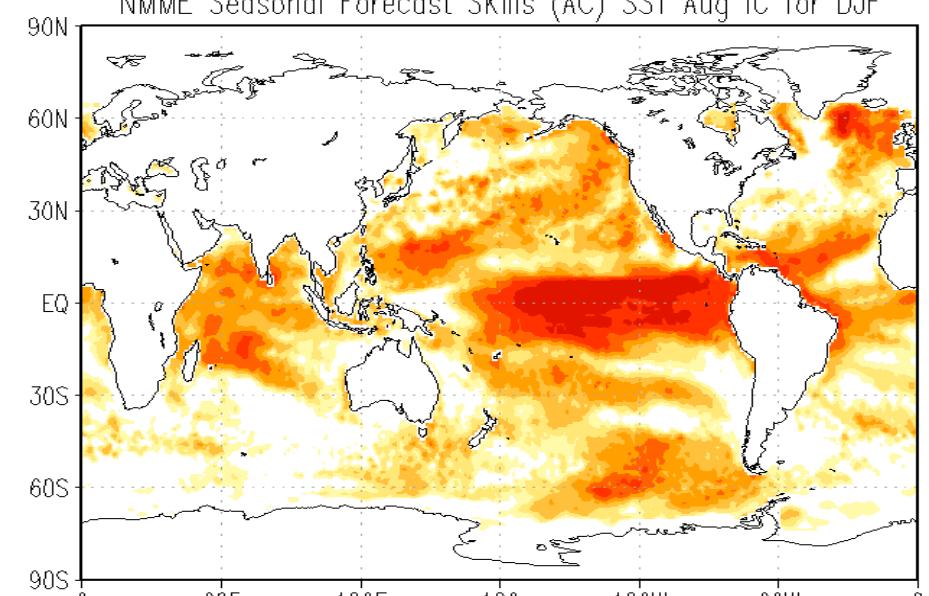


NMME Seasonal Forecast SKills (AC) SST Aug IC for NDJ

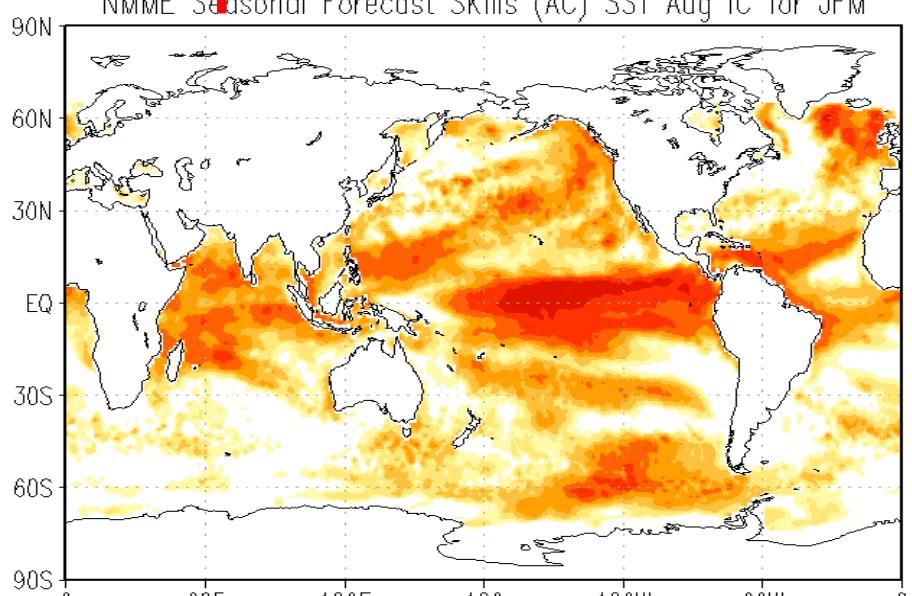


# Sea Surface Temperature

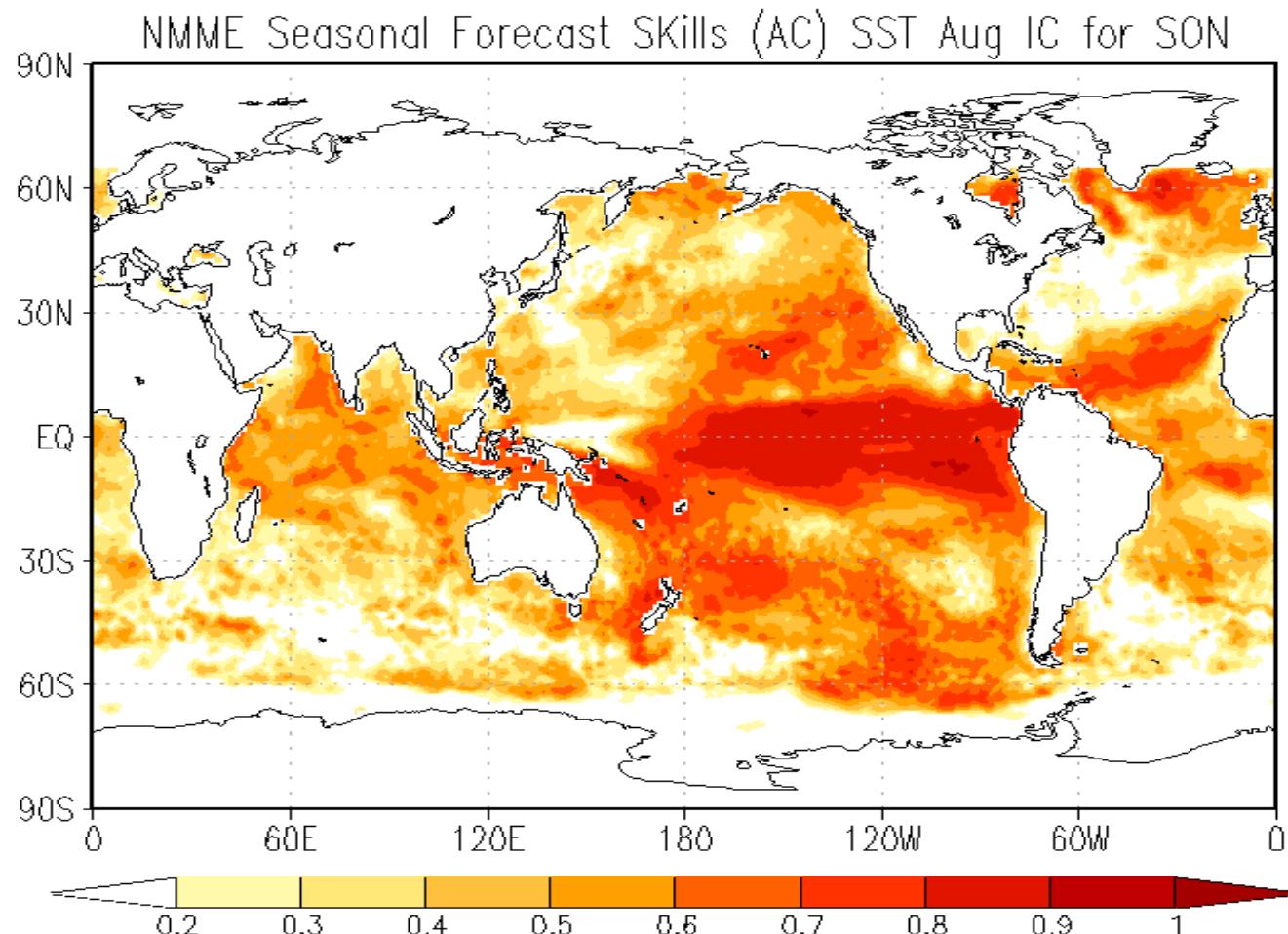
NMME Seasonal Forecast Skills (AC) SST Aug IC for DJF



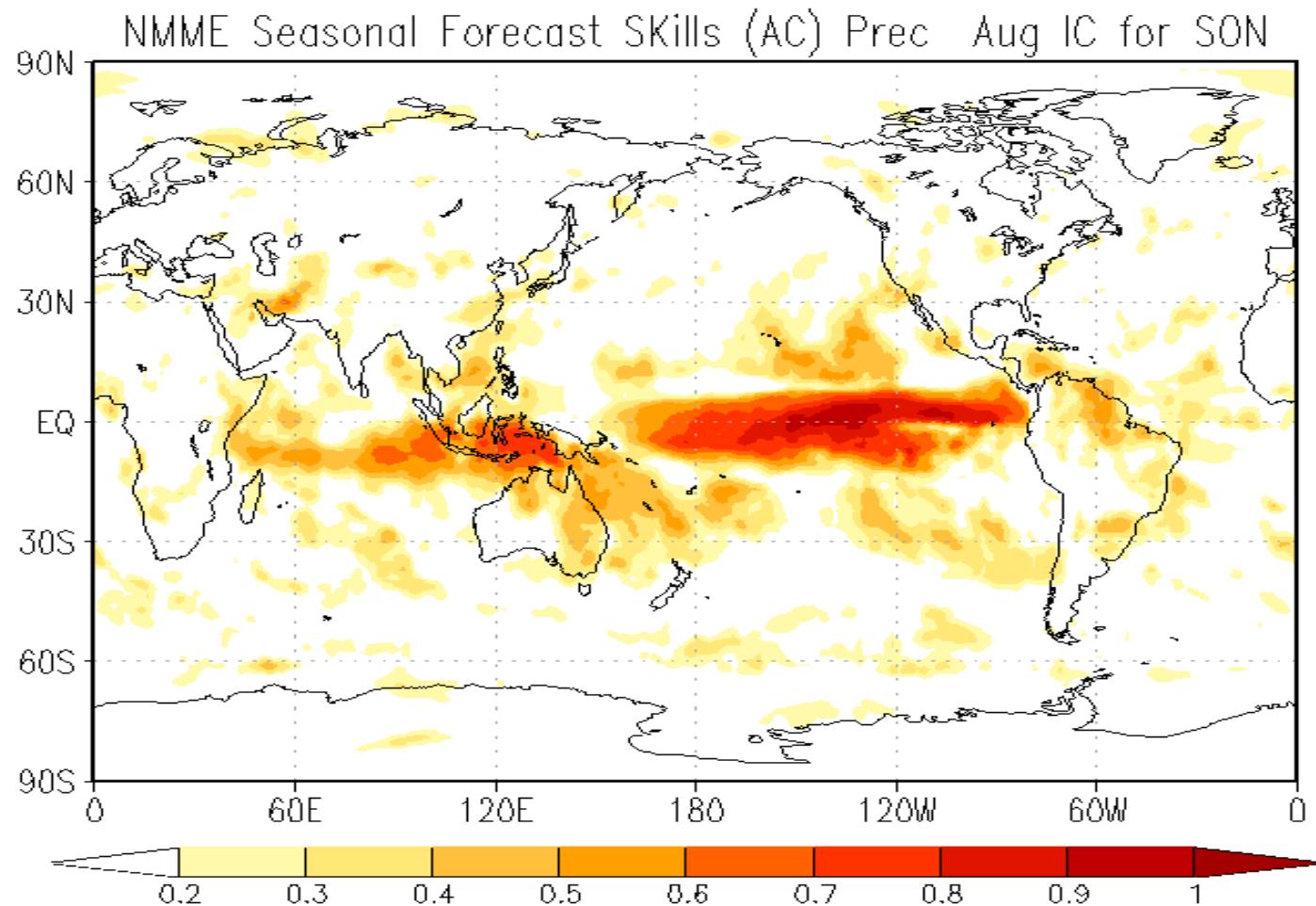
NMME Seasonal Forecast SKills (AC) SST Aug IC for JFM



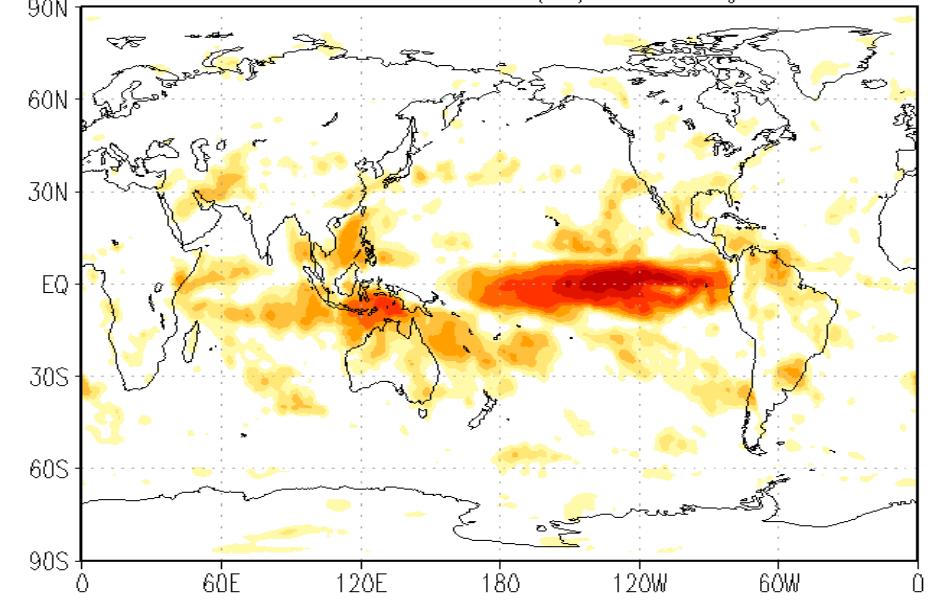
# Seasonal Forecast Skills



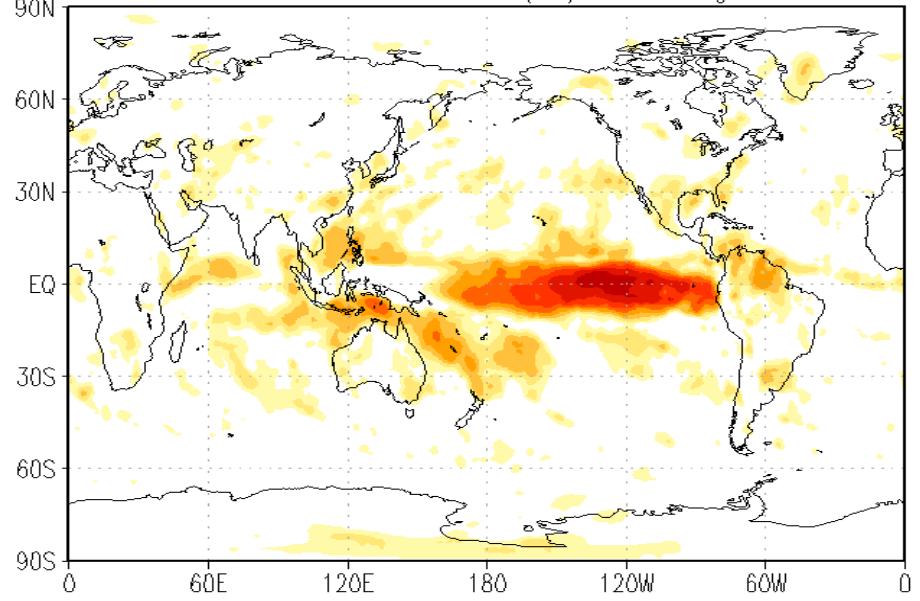
# Seasonal Forecast Skills



NMME Seasonal Forecast SKills (AC) Prec Aug IC for OND

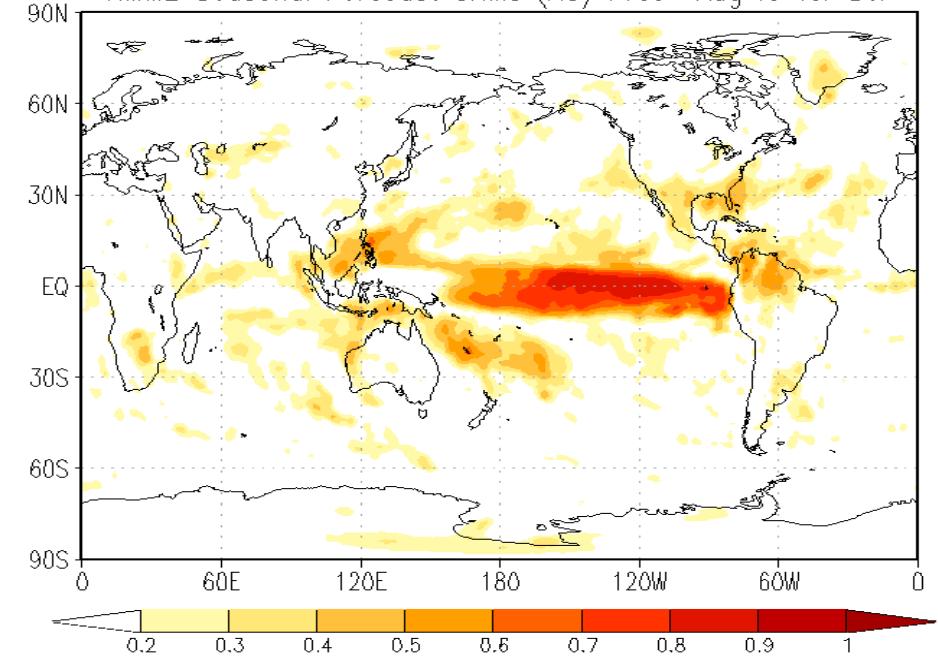


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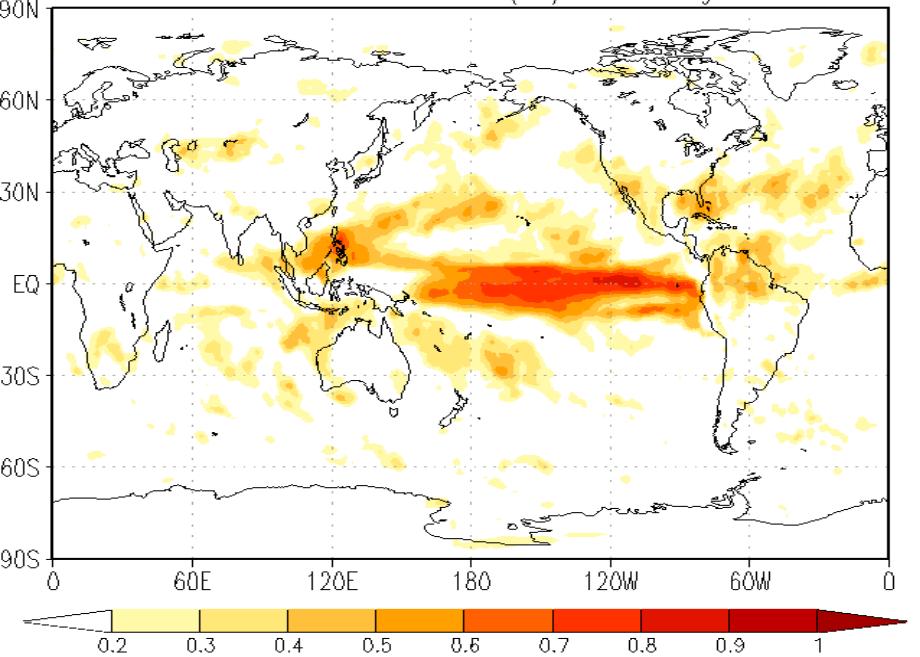


# Precipitation

NMME Seasonal Forecast SKills (AC) Prec Aug IC for DJF



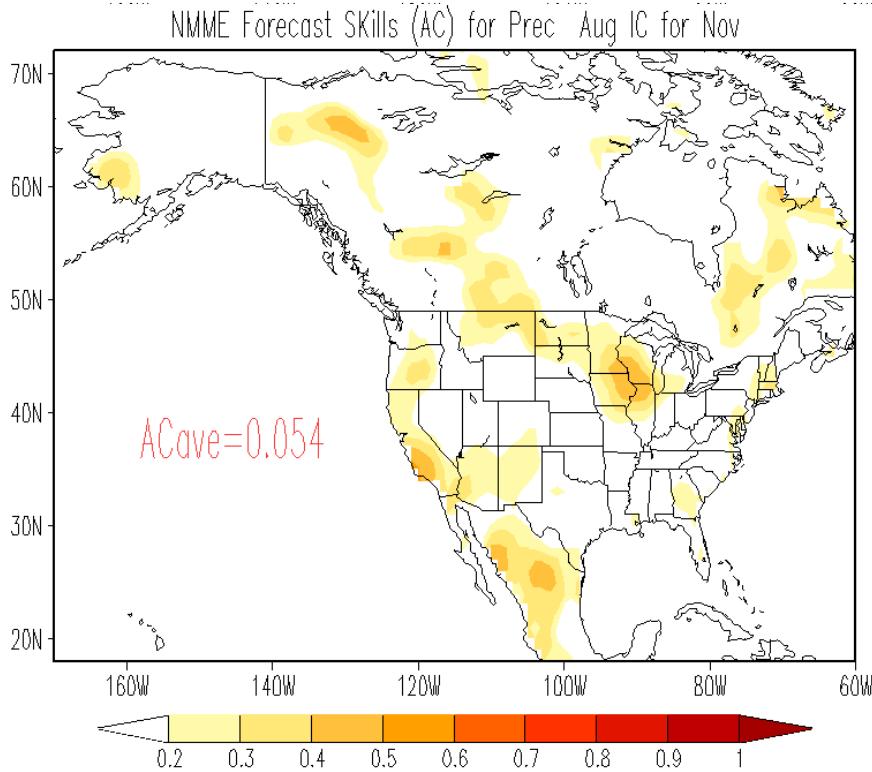
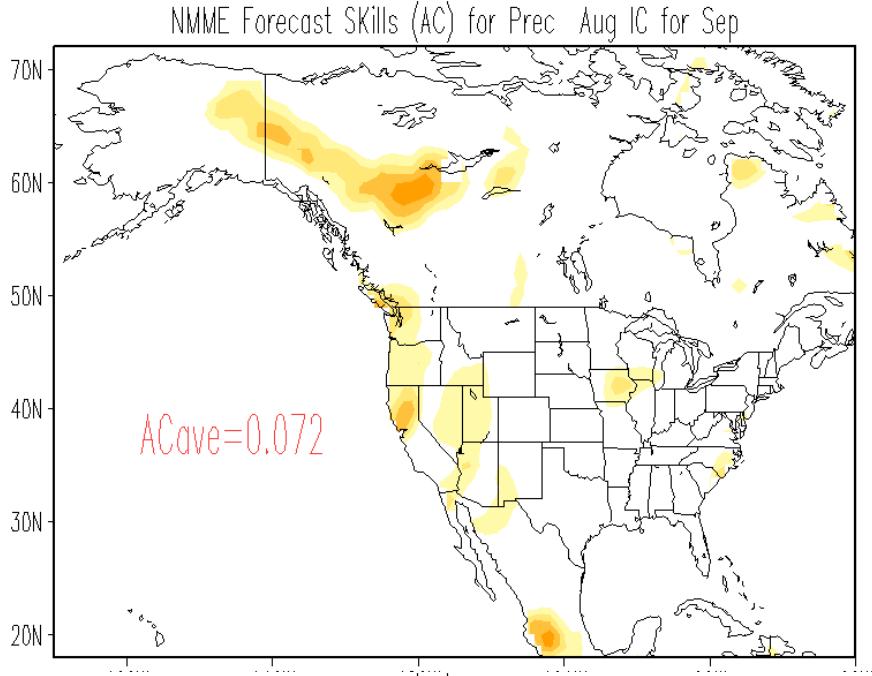
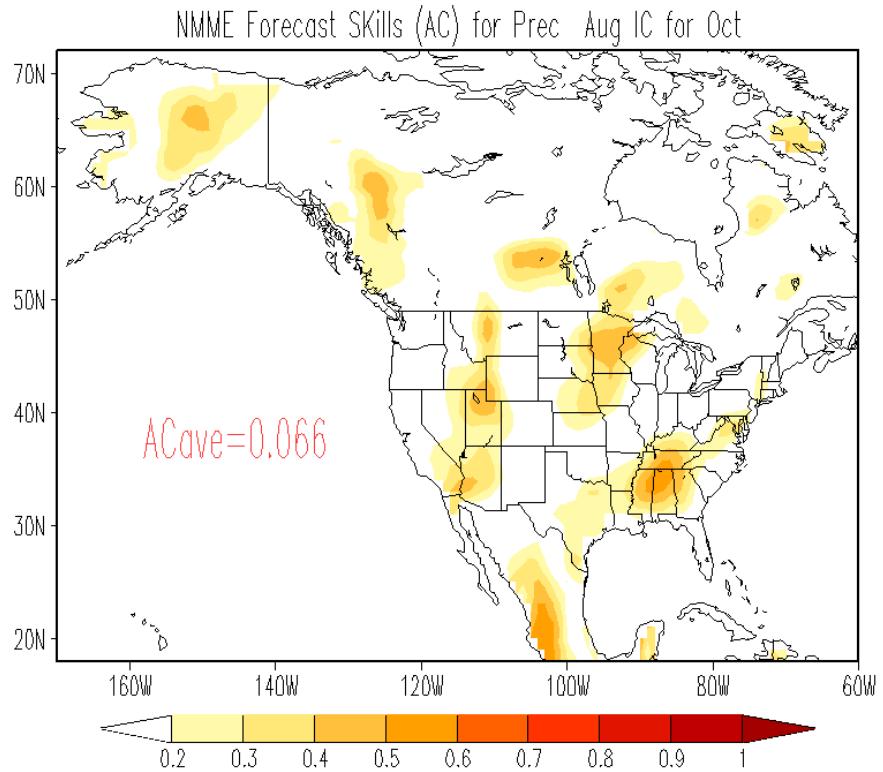
NMME Seasonal Forecast SKills (AC) Prec Aug IC for JFM



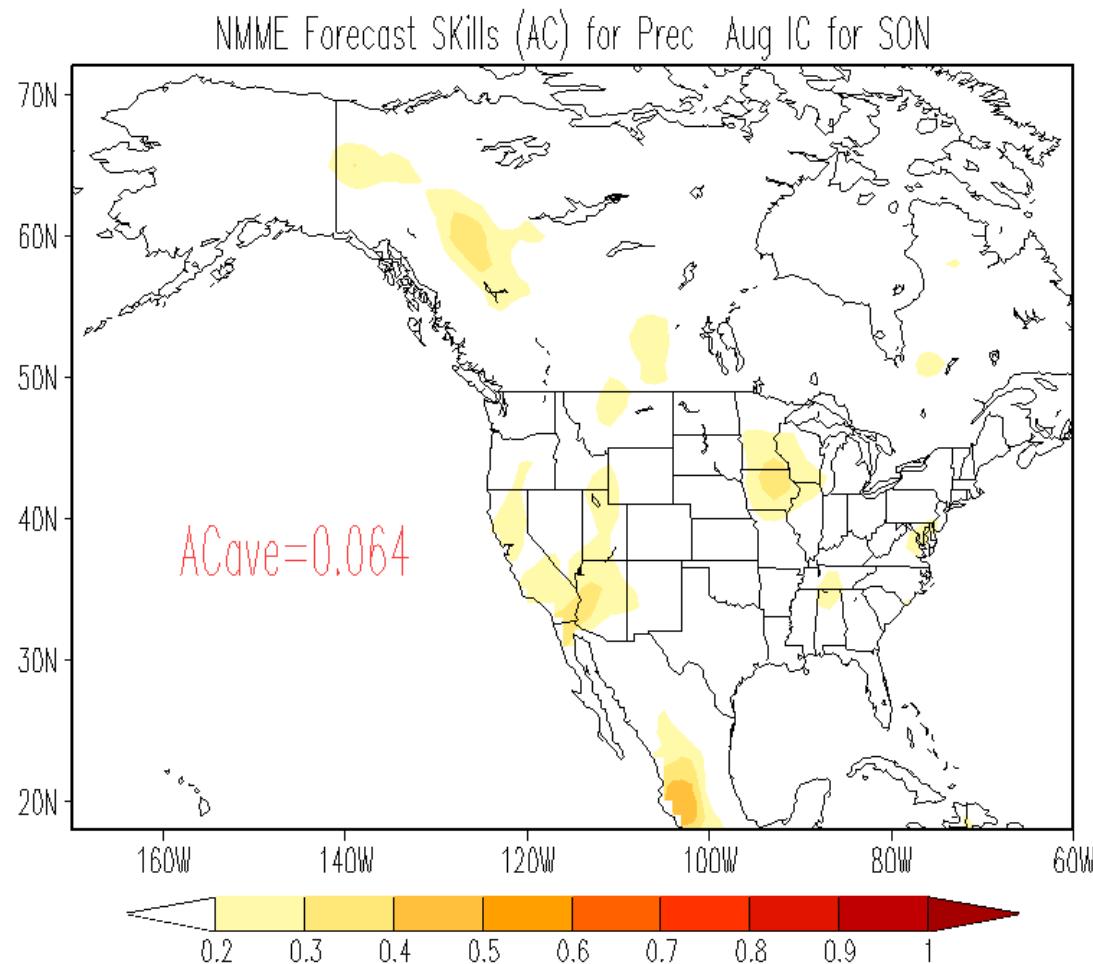
# Precipitation North America

## Verification observation

- CMAP
- 1982-2009

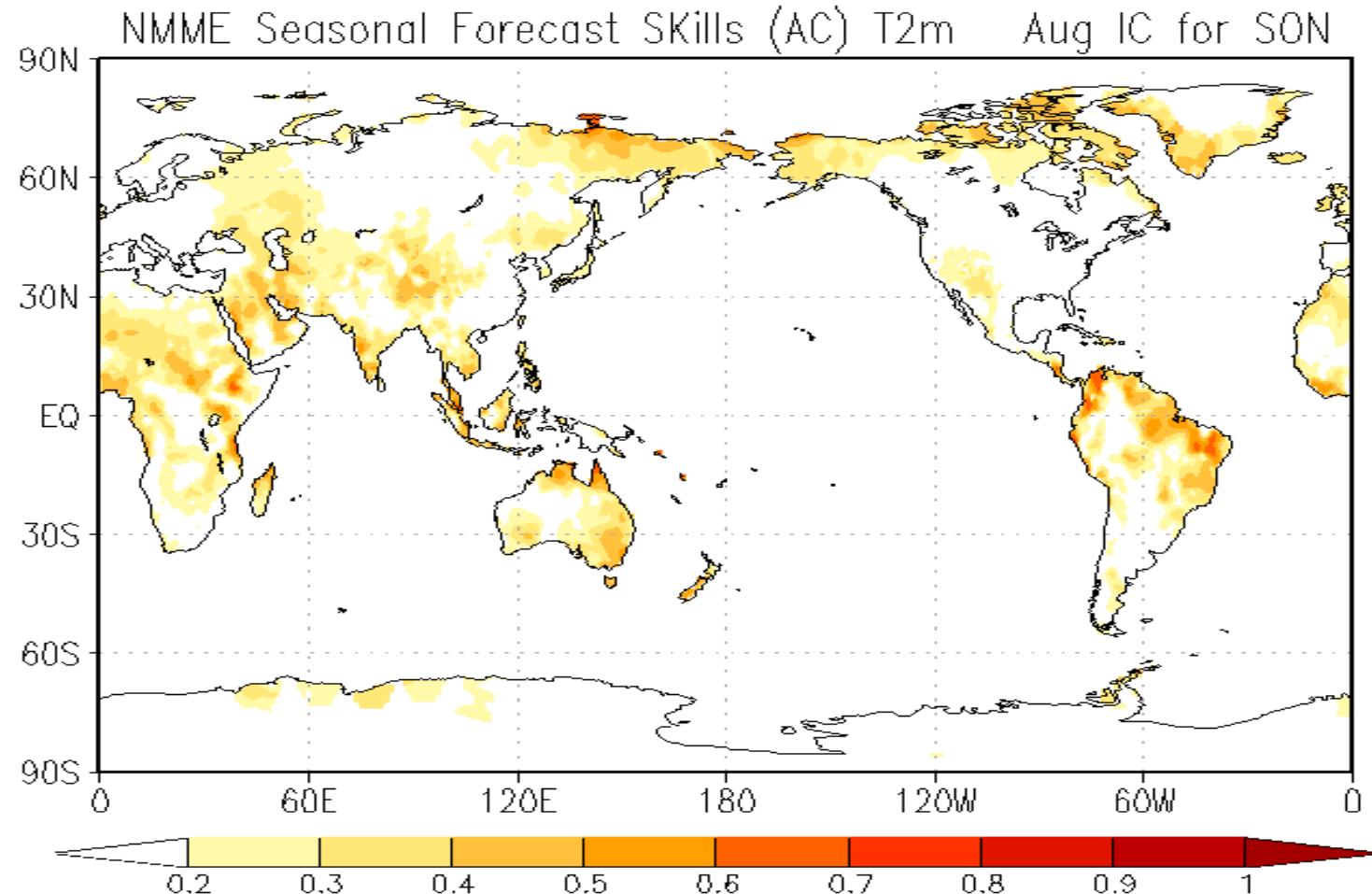


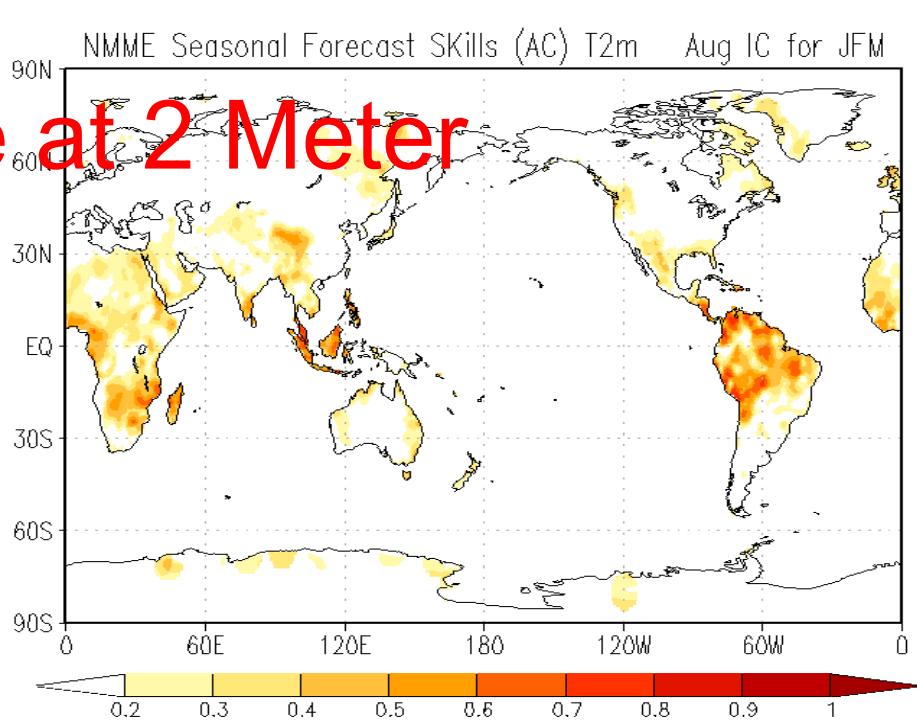
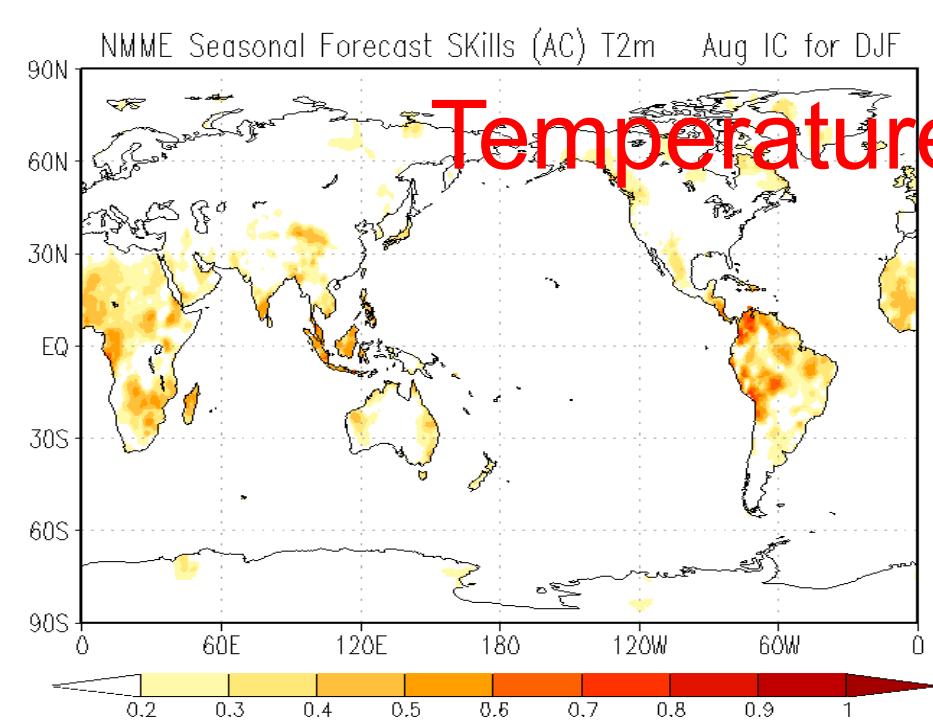
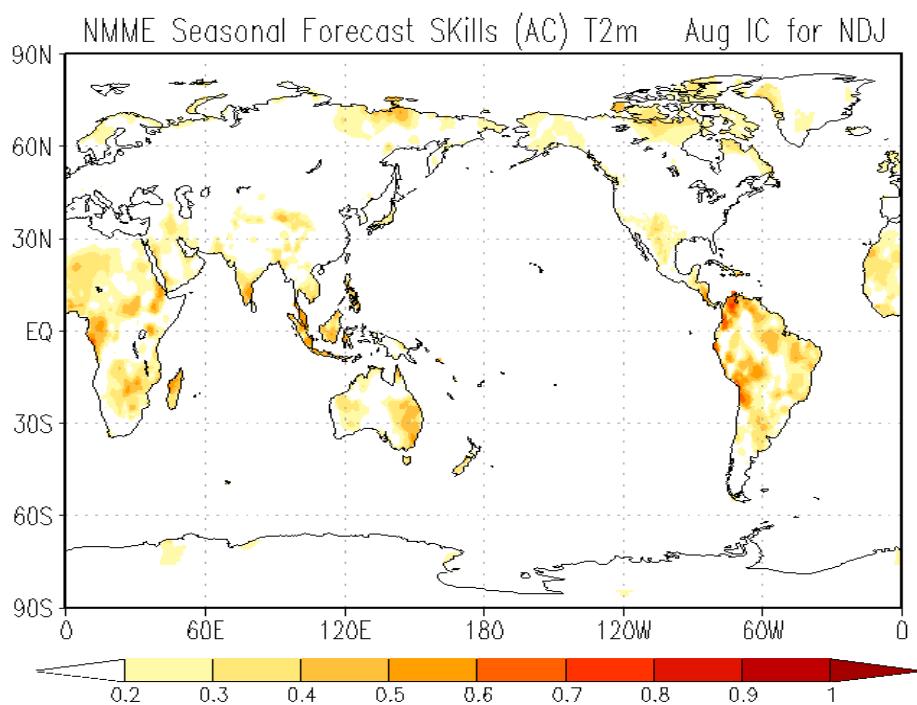
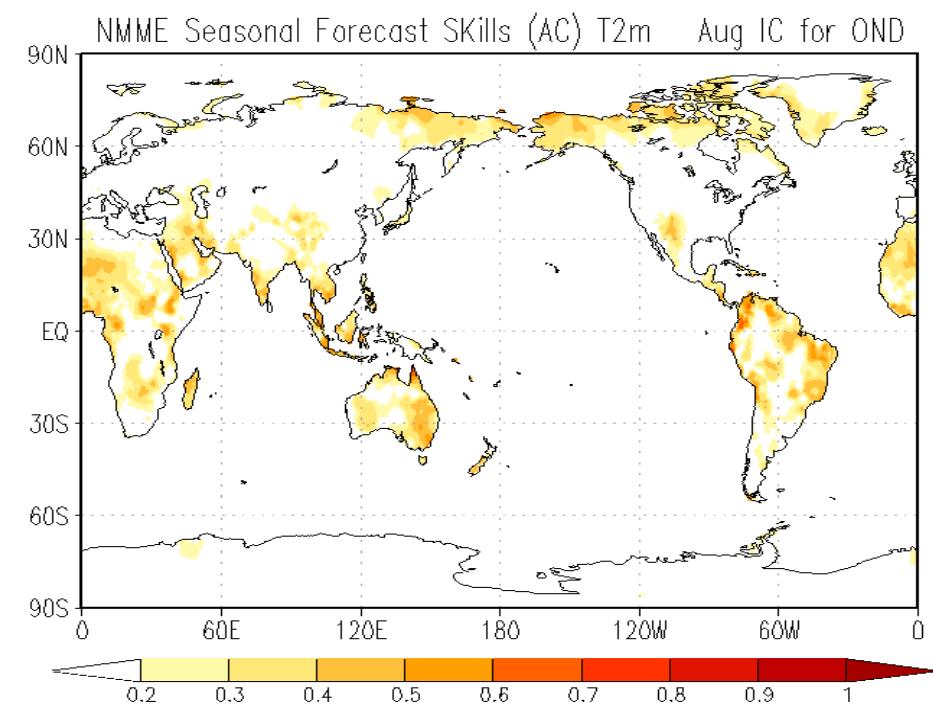
# Seasonal Forecast Skills



Precipitation

# Seasonal Forecast Skills



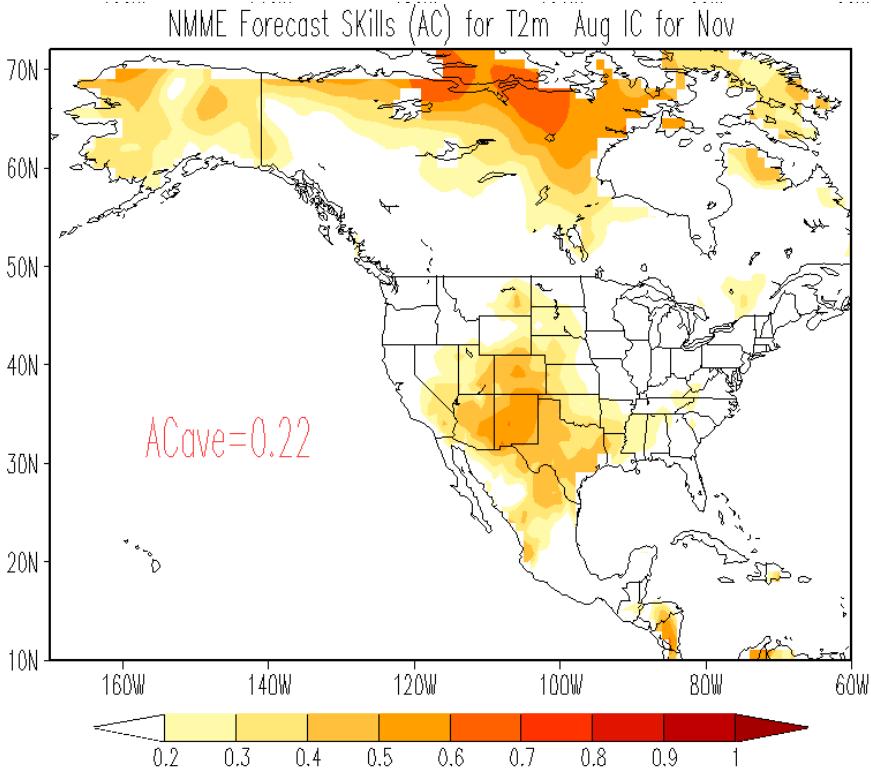
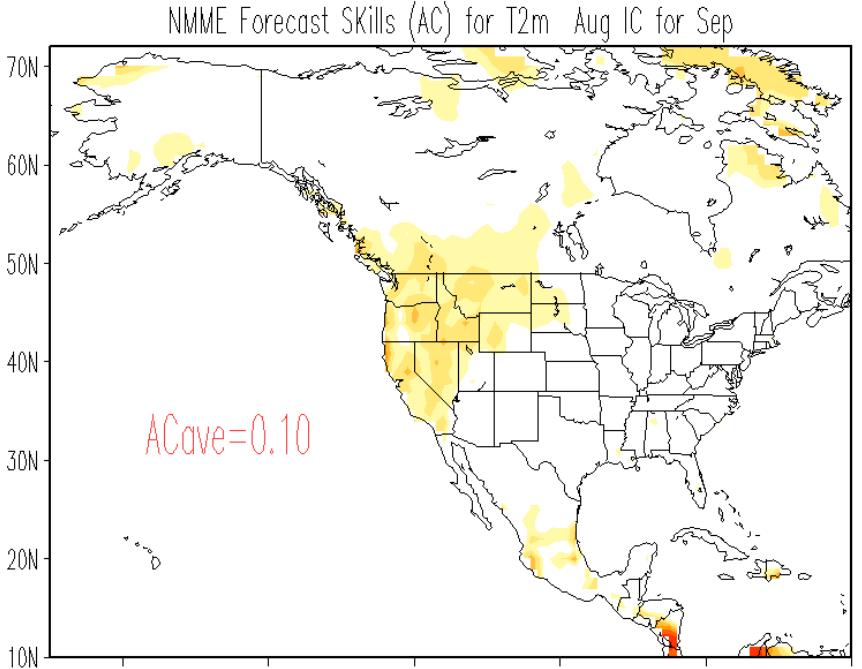
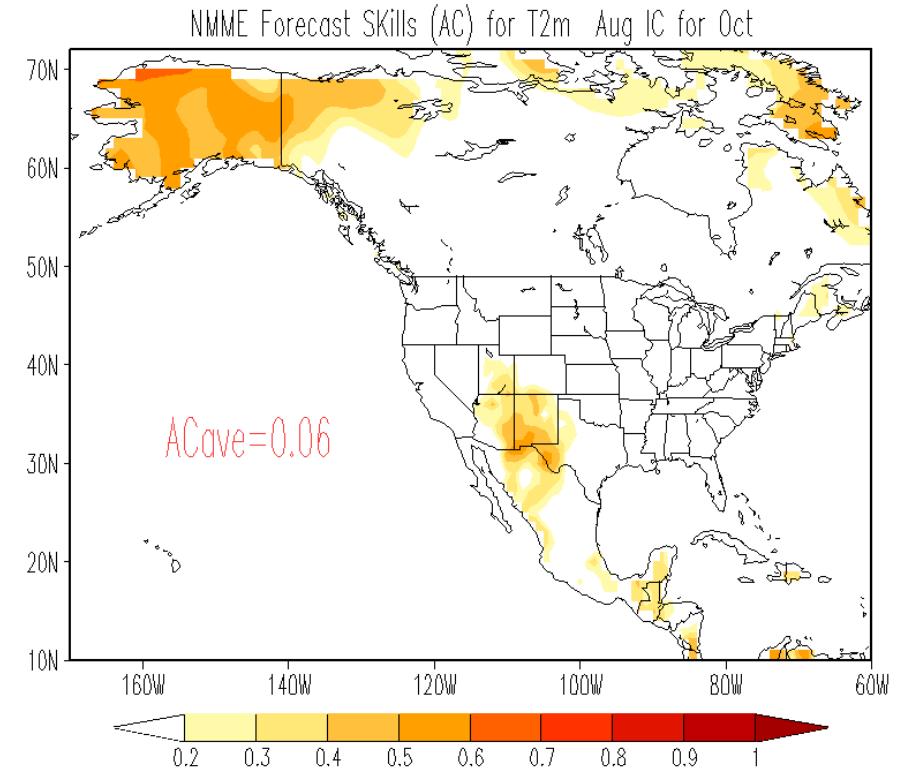


Temperature at 2 Meter

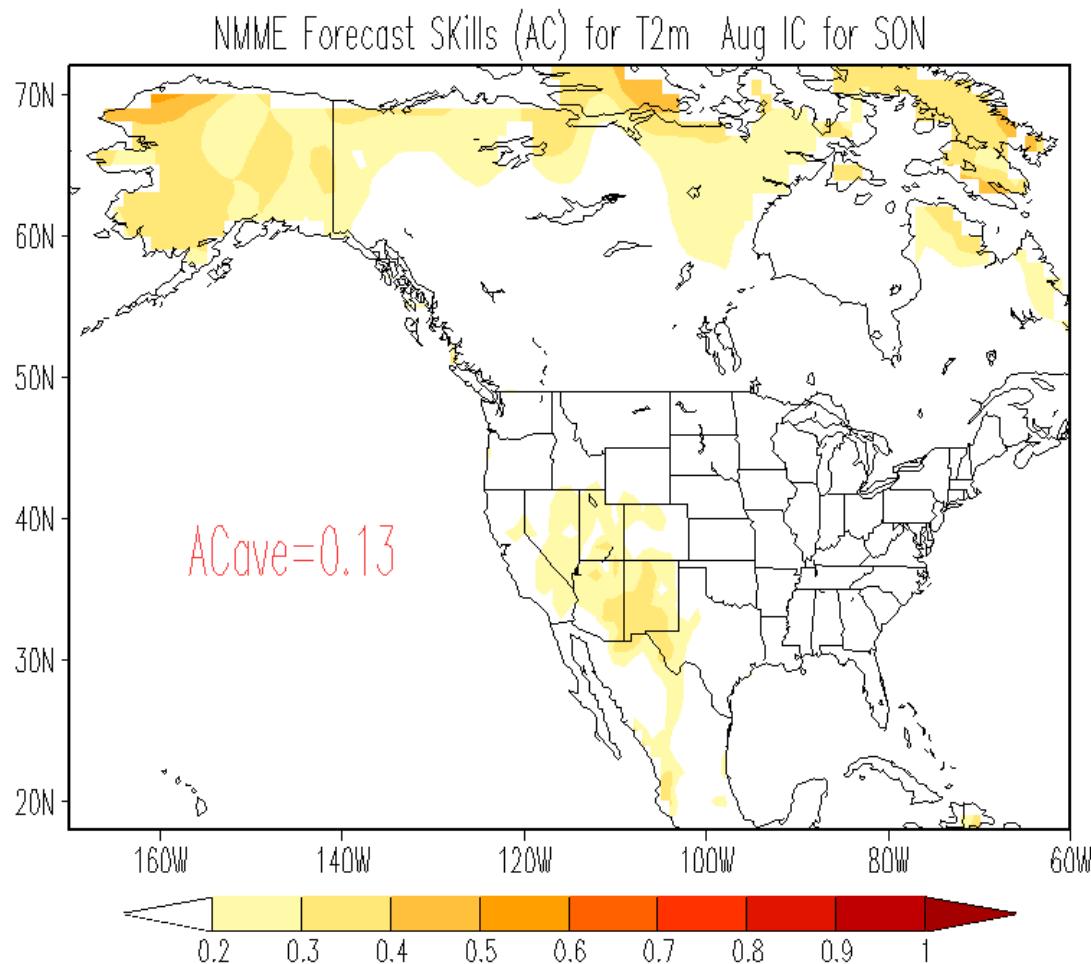
# Temperature at 2 Meter North America

## Verification observation

- GHCN\_CAMS
- 1982-2009



# Seasonal Forecast Skills



Temperature at 2 Meter